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International Space Station Thermal Control System Book

ISS-Expedition 1

Mission Operations Directorate
Operations Division

Preliminary
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INTERNATIONAL SPACE STATION
THERMAL CONTROL SYSTEM BOOK
ISS-EXPEDITION 1

PRELIMINARY
March 11, 1998

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This document is not currently under the configuration control of the Systems Operations Data File Control Board (SODFCB). During the interim, changes may be submitted to the book manager.

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CONTENTS

The SODF procedures listed here are for the use of the Expedition 1 crew. By final publication, all applicable Increment 1 procedures will be included in this list. The current list of procedures is for use from 2R docking to 5A docking based on Rev C Assembly Sequence.

NOMINAL PROCEDURES

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EEATC PFCS FCV MANUAL RECALIBRATION

1. INHIBIT FCV SOFTWARE ALGORITHMS

PCS P6: TCS: EEATCS Overview: LOOPA(B) PFCS
LOOPA(B) PFCS Nominal Commands

cmd FCV Cntl Inh Arm
cmd FCV Cntl Inh Fire
√FCV Cntl - Inh
cmd FCV Setpt Set 1-Step **Execute**
√FCV Setpt Set Cmd 1-Step - True

sel Loop A(B) PFCS FDIR Commands

LoopA(B) PFCS FDIR Commands

cmd Auto FCV Recal Inh Arm
cmd Auto FCV Recal Inh Fire
√Auto FCV Recal - Inh

cmd FCV Fail Rcvy Inh Arm
cmd FCV Fail Rcvy Inh Fire
√FCV Fail Rcvy - Inh

√Max Out Temp Shutdn - Inh

2. INHIBIT NH3 LINE HEATER CONTROL AND OPEN ASSOCIATED RPCs

PCS P6: TCS: EEATCS Overview: EEATC Line Heater
EEATC Line Heater Commands

cmd Loop A(B) Line Htr Cntl Inh Arm
cmd Loop A(B) Line Htr Cntl Inh Fire
√Loop A(B) Line Htr Cntl - Inh

sel Ln Htr1 RPCM 4B(2B) A RPC 05

RPCM 4B(2B) A RPC 05

cmd RPC Position Open
√RPC Position - Open

PCS P6: TCS: EEATCS Overview: EEATC Line Heater
EEATC Line Heater Commands

sel Ln Htr2 RPCM 4B(2B) A RPC 06

RPCM 4B(2B) A RPC 06

cmd RPC Position Open
√RPC Position - Open

3. COMMAND THE FCV TO A KNOWN HARDSTOP LOCATION

PCS P6: TCS: EEATCS Overview: LOOP A(B) PFCS
LoopA(B) PFCS Nominal Commands

sel TBD

cmd FCV Initial Setpt Set = 1.0 **Execute**
cmd FCV Setpt Set = 0.0 **Execute**

Verify 'FCV Integ Posn' value is incrementing.
Wait 12 seconds for hardware response.

Repeat 3 times

cmd FCV Initial Setpt Set = 1.0 **Execute**
cmd FCV Setpt Set = 0.56 **Execute**

Verify 'FCV Integ Posn' value is incrementing.
Wait 12 seconds for hardware response.

cmd FCV Initial Setpt Set = 0.0 **Execute**
cmd FCV Setpt Set = TBD (hardstop to bypass angle) **Execute**

Verify 'FCV Integ Posn' value is incrementing.
Wait 12 seconds for hardware response.

4. ENABLE FCV CLOSED LOOP CONTROL

NOTE
FCV has now been manually recalibrated. Enabling FCV close loop control should allow the software to control to the 'PFCS Out Fltrd Lwr Temp setpoint'. Contact **MCC** for GO/NO-GO to step 5.

PCS P6: TCS: EEATCS Overview: LOOP A(B) PFCS
LoopA(B) PFCS Nominal Commands

cmd FCV Cntl Ena Arm
cmd FCV Cntl Ena Fire
√FCV Cntl - Inh

5. ENABLE FCV FDIR ALGORITHMS

PCS P6: TCS: EEATCS Overview: LOOPA (B) PFCS
LOOPA(B) PFCS Nominal Commands

sel Loop A(B) PFCS FDIR Commands

LoopA(B) PFCS FDIR Commands

cmd FCV Fail Rcvy Ena Arm
cmd FCV Fail Rcvy Ena Fire
√FCV Fail Rcvy - Ena

6. ENABLE NH3 LINE HEATER CONTROL AND OPEN ASSOCIATED RPCs

PCS P6: TCS: EEATCS Overview: EEATC Line Heater

EEATC Line Heater Commands

cmd Loop A(B) Line Htr Cntl Ena Arm
cmd Loop A(B) Line Htr Cntl Ena Fire
√Loop A(B) Line Htr Cntl - Ena

EEATC LOOP A PFCS PUMP A,B SHUTDOWN

1. CONFIGURE LINE HEATER FUNCTIONAL INHIBITS

PCS P6: TCS: EEATCS Overview: Loop A PFCS Line Heater Icon
LoopA Line Heater Commands

cmd EEATC A PFCS Line Htr Cntl Inh - Arm
cmd EEATC A PFCS Line Htr Cntl Inh - Fire
√EEATC A PFCS Line Htr Cntl - Inh

2. CHECK PFCS LOOP A IN-LINE HEATER RPCS ARE OPEN

PCS P6: TCS: EEATCS Overview: Loop A PFCS Line Heater Icon
LoopA Line Heater Commands

√EEATC A PFCS Ln Htr 1,2 RPC Posn - Open

3. POWER OFF PFCS LOOP A PUMPS A,B

PCS P6: TCS: EEATCS Overview: Loop A PFCS
LoopA PFCS Nominal Commands

If EEATC A PFCS Pump A(B) Cmd Stat - On
cmd EEATC A PFCS Pump A(B) - Off

√Cmd Stat - Off
Verify Pump A,B Conv Spd: 0 ± 975 rpm

EEATC LOOP A PFCS PUMP A(B) SWITCHOVER (MANUAL)

1. COMMAND PUMP A(B) OFF AND VERIFY THAT IT IS OFF

> NOTE
> Step 2 should be performed immediately after completion of step 1 to ensure that the loop is not operating for only a short period of time.

PCS P6: TCS: EEATCS Overview: LOOP A PFCS
LoopA PFCS Nominal Commands

cmd EEATC A PFCS Pump A(B) - Off

Verify EEATC A PFCS Pump A(B) Cmd Stat - Off
Verify EEATC A PFCS Pump A(B) Conv Spd: 0 ± 975 rpm

2. COMMAND PUMP B(A) ON AND VERIFY THAT IT IS ON

PCS P6: TCS: EEATCS Overview: LOOP A PFCS
LoopA PFCS Nominal Commands

> **CAUTION**
> If the Loop A PFCS In Press or PFCS Out Press < 896 kPa, do not start the pump. There is a potential for cavitation below this pressure.

If EEATC A PFCS Integ In Press ≥ 896 kPa and EEATC A PFCS Integ Out Press ≥ 896 kPa

cmd EEATC A PFCS Pump B(A) Pwr - On

Verify EEATC A PFCS Pump B(A) Cmd Stat - On
Verify EEATC A PFCS Pump B(A) Conv Spd: 13250 ± 500 rpm

If EEATC A PFCS Integ In Press ≤ 895 kPa and EEATC A PFCS Integ Out Press ≤ 896 kPa

√**MCC**

3. VERIFY THE INLET AND OUTLET PRESSURE AND FLOWRATE

PCS P6: TCS: EEATCS Overview
EEATCS Overview

Verify EEATC A PFCS Integ Flow Rate ≥ 530 kg/hr (1170 lbm/hr) and ≤ 908 kg/hr (2000 lbm/hr)
Verify EEATC A PFCS Integ In Press ≥ 648 kPa (94 psia) and ≤ 1999 kPa (290 psia)
Verify EEATC A PFCS Integ Out Press ≥ 648 kPa (94 psia) and ≤ 1999 kPa (290 psia)

EEATC LOOP A(B) PFCS SHUTDOWN

1. CONFIGURE LINE HEATER FUNCTIONAL INHIBITS

PCS P6: TCS: EEATCS Overview: Loop A(B) PFCS Line Heater Icon
LoopA(B) Line Heater Commands

cmd EEATC A(B) PFCS Line Htr Cntl Inh - Arm
cmd EEATC A(B) PFCS Line Htr Cntl Inh - Fire
√EEATC A(B) PFCS Line Htr Cntl - Inh

2. CHECK PFCS LOOP A(B) IN-LINE HEATER RPCS ARE OPEN

PCS P6: TCS: EEATCS Overview: Loop A(B) PFCS Line Heater Icon
LoopA(B) Line Heater Commands

√EEATC A(B) PFCS Ln Htr 1,2 RPC Posn - Open

NOTE
All PFCS sensor data (except for the EEATC A(B) PFCS Out Line Fltrd Temp) is invalid following completion of the PFCS loop power off procedure.

3. POWER OFF LOOP A(B) PFCS

PCS P6: TCS: EEATCS Overview: Loop A(B) PFCS: RPCM 4B(2B) A RPC 04
RPCM 4B(2B) A RPC 04

cmd EEATC A(B) PFCS RPC Position - Open **Execute**
√ - Open

EEATC LOOP B PFCS PUMP A,B SHUTDOWN

1. CONFIGURE LINE HEATER FUNCTIONAL INHIBITS

PCS P6: TCS: EEATCS Overview: Loop B PFCS Line Heater Icon
LoopB Line Heater Commands

cmd EEATC B PFCS Line Htr Cntl Inh - Arm
cmd EEATC B PFCS Line Htr Cntl Inh - Fire
√EEATC B PFCS Line Htr Cntl - Inh

2. CHECK PFCS LOOP B IN-LINE HEATER RPCS ARE OPEN

PCS P6: TCS: EEATCS Overview: Loop B PFCS Line Heater Icon
LoopB Line Heater Commands

√EEATC B PFCS Ln Htr 1,2 RPC Posn - Open

3. POWER OFF PFCS LOOP B PUMPS A,B

PCS P6: TCS: EEATCS Overview: Loop B PFCS
LoopB PFCS Nominal Commands

If EEATC B PFCS Pump A(B) Cmd Stat - On

cmd EEATC B PFCS Pump A(B) - Off
√Cmd Stat - Off
Verify EEATC B PFCS Pump A,B Conv Spd: 0 ± 975 rpm

EEATC RADIATOR DEPLOY

1. VERIFY PVCA RADIATOR MOTOR AUTO FDIR AND SHUTOFF STATUS

   TTCR(STCR) Commands

PCS P6: TCS: EEATCS Overview: TTCR(STCR)

√EEATC A(B) TTCR(STCR) Config Fail FDIR - Ena
√Auto Time Out FDIR - Ena
√Auto Off - Ena

2. MOTOR POWER-ON AND STATUS VERIFICATION

   TTCR(STCR) Commands

PCS P6: TCS: EEATCS Overview: TTCR(STCR)

cmd EEATC A(B) TTCR(STCR) Pwr On Arm
cmd EEATC A(B) TTCR(STCR) Pwr On Fire

Verify EEATC A(B) TTCR(STCR) Power Command Stat - On
Deployed (in telemetry) - Not Deplyd
Retracted (in telemetry) - Retrctd
Ovl Trip (in telemetry) - Not Tripped

3. VISUALLY CONFIRM RADIATOR IS READY FOR DEPLOYMENT
   Crewmember must confirm visually (via direct viewing or camera) the radiator is ready for deployment and that all launch restraints have been removed.

WARNING

If deployment takes place during an EVA, ensure no EVA activities are being held within the deploy envelope of the radiator to avoid potential injury to EVA crewmember.

CAUTION

Propulsive attitude control must be inhibited prior to radiator deploy.

4. START RADIATOR DEPLOYMENT AND MONITOR STATUS

CAUTION

Each EEATCS loop pressures must be ≤ 2068 kPa to prevent damaging the radiator during deployment.

NOTE

1. Radiator deployment may take up to 10 minutes but the Config Fail FDIR function will perform auto shutdown after 13 minutes.

2. Auto-off function should automatically shutdown drive motor after full deployment.

3. Perturbations of quantity sensor data may occur due to the motion of the array but should average out.

4. Crewmember should confirm visually (via direct viewing or camera) that the radiator fully deploys.

TTCR(STCR) Commands

PCS P6: TCS: EEATCS Overview: TTCR(STCR)

cmd EEATC A(B) TTCR(STCR) Deploy Arm
cmd EEATC A(B) TTCR(STCR) Deploy Fire

Monitor and verify the following parameters during operation.

PARAMETER	STOWED	TRANSITION	DEPLOYED (after 10 min)
Cmd Stat	Stop	Deploy	Stop
Power Cmd Stat	On	On	Off
Deployed (in telemetry area of display)	Not Deplyd	Not Deplyd	Deplyd
Retracted (in telemetry area of display)	Retrctd	Not Rtrctd	Not Rtrctd
Ovl Trip (in telemetry area of display)	Not Tripped	Not Tripped	Not Tripped

EEATC RADIATOR RETRACT

1. VERIFY PVCA RADIATOR MOTOR AUTO FDIR AND SHUTOFF STATUS

   TTCR(STCR) Commands

PCS P6: TCS: EEATCS Overview: TTCR(STCR)

√EEATC A(B) TTCR(STCR) Config Fail FDIR - Ena
√Auto Time Out FDIR - Ena
√Auto Off - Ena

2. MOTOR POWER-ON AND STATUS VERIFICATION

   TTCR(STCR) Commands

PCS P6: TCS: EEATCS Overview: TTCR(STCR)

cmd EEATC A(B) TTCR(STCR) Pwr On Arm
cmd EEATC A(B) TTCR(STCR) Pwr On Fire

Verify EEATC A(B) TTCR(STCR) Power Command Stat - On
Deployed (in telemetry) - Deplyd
Retracted (in telemetry) - Not Retrctd
Ovl Trip (in telemetry) - Not Tripped

3. VISUALLY CONFIRM RADIATOR IS READY FOR RETRACTION
   Crewmember must confirm visually (via direct viewing or camera) the radiator is ready for retraction and that all obstructions have been cleared.

WARNING

If retraction takes place during an EVA, ensure no EVA activities are being held within the retract envelope of the radiator to avoid potential injury to EVA crewmember.

CAUTION

Propulsive attitude control must be inhibited prior to radiator retract.

4. START RADIATOR RETRACTION AND MONITOR STATUS

CAUTION

Each EEATCS loop pressures must be ≤ 2068 kPa to prevent damaging the radiator during retraction.

NOTE

1. Radiator retraction may take up to 10 minutes but the Config Fail FDIR function will perform auto shutdown after 13 minutes.

2. Auto-off function should automatically shutdown drive motor after full retraction.

3. Perturbations of quantity sensor data may occur due to the motion of the array but should average out.

4. Crewmember should confirm visually (via direct viewing or camera) that the radiator fully retracts.

TTCR(STCR) Commands

PCS P6: TCS: EEATCS Overview: TTCR(STCR)

cmd EEATC A(B) TTCR(STCR) Retract Arm
cmd EEATC A(B) TTCR(STCR) Retract Fire

Monitor and verify the following parameters during operation.

PARAMETER	STOWED	TRANSITION	RETRACTED (after 10 min)
Cmd Stat	Stop	Retract	Stop
Power Cmd Stat	On	On	Off
Deployed (in telemetry area of display)	Deplyd	Not Deplyd	Not Deplyd
Retracted (in telemetry area of display)	Not Retrctd	Not Rtrctd	Rtrctd
Ovl Trip (in telemetry area of display)	Not Tripped	Not Tripped	Not Tripped

NODE 1/PMA 1 PRE-INGRESS HEATER RECONFIGURATION

1. VERIFY PMA1 AND NODE 1 A HEATERS INHIBITED

PCS Node 1: TCS

NODE1: TCS

√PMA 1 Htr A Availbty (four) - Inh

√Node 1 Htr A Availbty (nine) - Inh

2. INHIBIT PMA1 AND NODE 1 B HEATERS

PCS Node 1: TCS

NODE1: TCS

'PMA1'

> NOTE
> PMA 1 Heater 4B is not active and does not appear on the PCS NODE 1 TCS Display.

sel PMA 1(Node 1) Htr[X(Y)]B [X] = 1 2 3 5

[Y] = 1 2 3 5 6 7 8 9

sel PMA 1(Nod1) Htr[X(Y)]B Htr Commands

PMA1(Nod1) Htr[X(Y)]B COMMANDS

cmd Inh **Execute**

PMA1(Nod1) Htr[X(Y)]

√PMA 1(Nod1) Htr[X(Y)]B Availbty - Inh

Repeat

3. MODIFY SETPOINTS FOR ALL PMA 1 HEATER TEMP SENSORS

PCS Node 1: TCS

NODE1: TCS

'PMA1'

> NOTE
> PMA 1 Heaters 2A and 4B are not active and do not appear on the PCS NODE 1 TCS Display.

sel PMA 1 Htr[X(Y)]A(B) [X] = | 1 | 3 | 4 | 5 |

[Y] = | 1 | 2 | 3 | 5 |

PMA1 Htr[X(Y)]

sel PMA 1 Htr[X(Y)]A(B) Htr Commands

PMA1 Htr[X(Y)]A(B) COMMANDS

NOTE

Specific values to be entered in the template command below for each PMA 1 Temperature Sensor are provided in Table 1 - PMA 1/Node 1 Heater Configuration Table. Values are provided for each of the five items in the template: Upper Setpoint, Failure Upper Limit, Lower Setpoint, Failure Lower Limit, and Cyclic Load Delta.

cmd Update PMA 1 Htr[X(Y)]A(B) Temp Snsr Setpoints
sel Upper Setpoint
Failure Upper Limit
Lower Setpoint
Failure Lower Limit
Cyclic Load Delta **Execute**

PMA1 Htr[X(Y)]

NOTE

The specific values to be verified in the step below are provided in Table 1.

√PMA 1 Htr[X(Y)]A(B) Upper Setpoint
√Failure Upper Limit
√Lower Setpoint
√Failure Lower Limit
√Cyclic Load Delta

Repeat

4. MODIFY SETPOINTS FOR ALL NODE 1 HEATER TEMP SENSORS

PCS Node 1: TCS

NODE1: TCS

'NODE1'

sel Node 1 Htr[X]A,B [X] = | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

Nod1 Htr[X]

sel Nod1 Htr[X]A,B Htr Commands

Nod1 Htr[X]A,B COMMANDS

NOTE

1. Specific values to be entered in the template command below for each Node 1 Temperature Sensor are provided in Table 1. Values are provided for each of the five items in the template: Upper Setpoint, Failure Upper Limit, Lower Setpoint, Failure Lower Limit, and Cyclic Load Delta.

2. As depicted on the PCS NODE 1 TCS display, ten of the eighteen Node 1 Heaters have two temperature sensors (Heaters 1A, 1B, 3A, 3B, 5A, 5B, 6A, 6B, 7A, and 7B). For these heaters, setpoints for both temperature sensors must be changed. Values for both sensors are provided in Table 1.

cmd Update Nod1 Htr[X]A,B Temp Snsr Setpoints
sel Upper Setpoint
Failure Upper Limit
Lower Setpoint
Failure Lower Limit
Cyclic Load Delta **Execute**

Nod1 Htr[X]

NOTE

The specific values to be verified in the step below are provided in Table 1.

√Nod1 Htr[X]A,B Upper Setpoint
√Failure Upper Limit
√Lower Setpoint
√Failure Lower Limit
√Cyclic Load Delta

Repeat

TABLE 1 - PMA 1/NODE 1 HEATER CONFIGURATION
PRE-INGRESS HEATER RECONFIG

PMA 1 HEATERS (ALL TEMPS IN °C)

HEATER	AVAIL-ABILITY	UPPER SETPOINT	FAILURE UPPER LIMIT	LOWER SETPOINT	FAILURE LOWER LIMIT	CYCLIC LOAD DELTA
1A	Inh	21	45	18	-18	0
1B	Inh	21	45	18	-18	0
2B	Inh	21	45	18	-18	0
3A	Inh	21	45	18	-18	0
3B	Inh	21	45	18	-18	0
4A	Inh	21	45	18	-18	0
5A	Inh	21	45	18	-18	0
5B	Inh	21	45	18	-18	0

NODE 1 HEATERS (ALL TEMPS IN °C)

HEATER (SENSOR)	AVAIL-ABILITY	UPPER SETPOINT	FAILURE UPPER LIMIT	LOWER SETPOINT	FAILURE LOWER LIMIT	CYCLIC LOAD DELTA
1A (Snsr 1)	Inh	21	45	18	-18	0
1A (Snsr 2)		21	45	18	-18	0
1B (Snsr 1)	Inh	21	45	18	-18	0
1B (Snsr 2)		21	45	18	-18	0
2A	Inh	21	45	18	-18	0
2B	Inh	21	45	18	-18	0
3A (Snsr 1)	Inh	21	45	18	-18	0
3A (Snsr 2)		21	45	18	-18	0
3B (Snsr 1)	Inh	21	45	18	-18	0
3B (Snsr 2)		21	45	18	-18	0
4A	Inh	21	45	18	-18	0
4B	Inh	21	45	18	-18	0
5A (Snsr 1)	Inh	21	45	18	-18	0
5A (Snsr 2)		21	45	18	-18	0
5B (Snsr 1)	Inh	21	45	18	-18	0
5B (Snsr 2)		21	45	18	-18	0
6A (Snsr 1)	Inh	21	45	18	-18	0
6A (Snsr 2)		21	45	18	-18	0
6B (Snsr 1)	Inh	21	45	18	-18	0
6B (snsr 2)		21	45	18	-18	0
7A(Snsr 1)	Inh	21	45	18	-18	0
7A (Snsr 2)		21	45	18	-18	0
7B (Snsr 1)	Inh	21	45	18	-18	0
7B (Snsr 2)		21	45	18	-18	0
8A	Inh	21	45	18	-18	0
8B	Inh	21	45	18	-18	0
9A	Inh	21	45	18	-18	0
9B	Inh	21	45	18	-18	0

NODE 1/PMA 1 SHELL WARMUP

1. DOCUMENT HEATER POWER ALLOCATION FOR WARM UP

NOTE
The heater power allocation recorded in this step is the total power available to the US segment minus the current housekeeping power.

√**MCC** for heater power allocation

Record heater power allocation: _____ W

2. NODE 1/PMA 1 SHELL HEATER PRIORITIZATION

PCS Node 1: TCS

NODE1: TCS

NOTE
Node 1 and PMA 1 Heaters are reconfigured at four hour intervals based on shell temperature and heater power allocation. The coldest areas of the PMA 1 or Node 1 Shell will be given the highest priority when heaters are enabled.

Enter a temperature reading for each Node 1 and PMA 1 Shell Heater in Table 1. For heaters with two temperature sensors, only the coldest temperature reading should be entered in the table.

Rank Node 1 and PMA 1 Shell Heaters from coldest to warmest and enter the rankings in Table 1. For heaters with identical temperatures, place heaters with lower power levels highest in the ranking.

In the priority order documented in Table 1, select a group of heaters that can be commanded to the “Enabled to Operate” state within the heater power allocation recorded in step 1.

NOTE
If a given heater will cause the total heater power to exceed the power allocation documented in Step 1 then that heater should be skipped and the next heater in priority order should be compared to the power allocation. All PMA 1 and Node 1 Shell Heaters should be evaluated in priority order.

3. INHIBIT PMA 1 AND NODE 1 HEATERS NOT SELECTED FOR WARMUP

> NOTE
> This step inhibits Node 1 and PMA 1 Shell Heaters which are Enabled to Operate but have not been selected for the next four hour warmup period.

PCS Node 1: TCS

NODE1: TCS

If any PMA 1(Node 1) Htr[X]A(B) not selected in step 2 is Ena Opr
sel PMA 1(Nod1) Htr[X]A(B) [X] = as required

sel PMA 1(Nod1) Htr[X]A(B) Htr Commands

PMA1(Nod1) Htr[X]A(B) COMMANDS

cmd Inh **Execute**

PMA1(Nod1) Htr[X]

√PMA 1(Nod1) Htr[X]A(B) Availbty - Inh

Repeat

4. ENABLE TO OPERATE PMA 1 AND NODE 1 HEATERS SELECTED FOR WARMUP

> NOTE
> This step enables Node 1 and PMA 1 Shell Heaters which are Inhibited but have been selected for the next four hour warmup period.

PCS Node 1: TCS

NODE1: TCS

If any PMA 1(Node 1) Htr[X]A(B) selected in step 2 is Inh
sel PMA 1(Nod1) Htr[X]A(B) Htr Commands [X] = as required

PMA1(Nod1) Htr[X]A(B) COMMANDS

cmd Ena Opr **Execute**

PMA1(Nod1) Htr[X]

√PMA 1(Nod1) Htr1A(B) Availbty - Ena Opr

Repeat

Wait 4 hours and repeat steps 2 to 4 until all Node 1 and PMA 1 Shell temperatures are ≥ 18° C.

5. INIHIBIT A HEATERS AND ENABLE TO OPERATE B HEATERS FOR NODE 1/PMA 1 SHELL TEMPERATURE MAINTENANCE

NOTE
Step 5 should be executed only after all PMA 1 and Node 1 Shell temperatures are ≥ 18 °C.

PCS

Node 1: TCS

NODE1: TCS

If any PMA 1(Node 1) Htr[X]A not Inh
sel PMA 1(Nod1) Htr[X]A Htr Commands [X] = as required

PMA1(Nod1) Htr[X]A COMMANDS

cmd Inh **Execute**

PMA1(Nod1) Htr[X]

√PMA 1(Nod1) Htr[X]A Availbty - Inh

Repeat

If any PMA 1(Nod1) Htr[X]B not Ena Opr
sel PMA 1(Nod1) Htr[X]B Htr Commands [X] = as required

PMA1(Nod1) Htr[X]B COMMANDS

cmd Ena Opr **Execute**

PMA1(Nod1) Htr[X]

√PMA 1(Nod1) Htr[X]B Availbty - Ena Opr

Repeat

NOTE
The final configuration for PMA 1 and Node 1 Heaters is provided in Table 2. The setpoints and failure limits for each temperature sensor are not changed in this procedure and are provided in Table 2 for reference only.

TABLE 1 - PMA 1/NODE 1 HEATER PRIORITIZATION

HEATER NAME	HEATER POWER (WATTS)	TEMP (deg C)	RANK	TEMP (deg C)	RANK	TEMP (deg C)	RANK
PMA 1 HTR 1A	68						
PMA 1 HTR 1B	68						
PMA 1 HTR 2B	68						
PMA 1 HTR 3A	68						
PMA 1 HTR 3B	68						
PMA 1 HTR 4A	68						
PMA 1 HTR 5A	68						
PMA 1 HTR 5B	68						
NODE 1 HTR 1A	274						
NODE 1 HTR 1B	174						
NODE 1 HTR 2A	110						
NODE 1 HTR 2B	80						
NODE 1 HTR 3A	180						
NODE 1 HTR 3B	180						
NODE 1 HTR 4A	180						
NODE 1 HTR 4B	180						
NODE 1 HTR 5A	180						
NODE 1 HTR 5B	180						
NODE 1 HTR 6A	180						
NODE 1 HTR 6B	180						
NODE 1 HTR 7A	99						
NODE 1 HTR 7B	99						
NODE 1 HTR 8A	66						
NODE 1 HTR 8B	66						
NODE 1 HTR 9A	121						
NODE 1 HTR 9B	145						

TABLE 2 - PMA1/NODE 1 HEATER CONFIGURATION TABLE
NODE 1/PMA 1 WARMUP

PMA 1 HEATERS (ALL TEMPS IN °C)

HEATER	AVAIL-ABILITY	UPPER SETPOINT	FAILURE UPPER LIMIT	LOWER SETPOINT	FAILURE LOWER LIMIT	CYCLIC LOAD DELTA
1A	Inh	21	45	18	-18	0
1B	Ena Opr	21	45	18	-18	0
2B	Ena Opr	21	45	18	-18	0
3A	Inh	21	45	18	-18	0
3B	Ena Opr	21	45	18	-18	0
4A	Inh	21	45	18	-18	0
5A	Inh	21	45	18	-18	0
5B	Ena Opr	21	45	18	-18	0

NODE 1 HEATERS (ALL TEMPS IN °C)

HEATER (SENSOR)	AVAIL-ABILITY	UPPER SETPOINT	FAILURE UPPER LIMIT	LOWER SETPOINT	FAILURE LOWER LIMIT	CYCLIC LOAD DELTA
1A (Snsr 1)	Inh	21	45	18	-18	0
1A (Snsr 2)		21	45	18	-18	0
1B (Snsr 1)	Ena Opr	21	45	18	-18	0
1B (Snsr 2)		21	45	18	-18	0
2A	Inh	21	45	18	-18	0
2B	Ena Opr	21	45	18	-18	0
3A (Snsr 1)	Inh	21	45	18	-18	0
3A (Snsr 2)		21	45	18	-18	0
3B (Snsr 1)	Ena Opr	21	45	18	-18	0
3B (Snsr 2)		21	45	18	-18	0
4A	Inh	21	45	18	-18	0
4B	Ena Opr	21	45	18	-18	0
5A (Snsr 1)	Inh	21	45	18	-18	0
5A (Snsr 2)		21	45	18	-18	0
5B (Snsr 1)	Ena Opr	21	45	18	-18	0
5B (Snsr 2)		21	45	18	-18	0
6A (Snsr 1)	Inh	21	45	18	-18	0
6A (Snsr 2)		21	45	18	-18	0
6B (Snsr 1)	Ena Opr	21	45	18	-18	0
6B (snsr 2)		21	45	18	-18	0
7A(Snsr 1)	Inh	21	45	18	-18	0
7A (Snsr 2)		21	45	18	-18	0
7B (Snsr 1)	Ena Opr	21	45	18	-18	0
7B (Snsr 2)		21	45	18	-18	0
8A	Inh	21	45	18	-18	0
8B	Ena Opr	21	45	18	-18	0
9A	Inh	21	45	18	-18	0
9B	Ena Opr	21	45	18	-18	0

MALFUNCTION PROCEDURES

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EEATC PFCS FCV RECAL FAILURE

Warning: EEATCA(B) PFCS FCV Recal Failure

Alarm Limit:
TBD

Nominal Config:
19.4° C (1.7° F) ≤ EEATCA(B) PFCS Out Filtered Lower Temp ≤ 8.3° C (47° F)

EEATCA(B) PFCS FCV Temp Recal FDIR - Inh

EEATCA(B) PFCS FCV Cntl - Ena

(1)

1
P6: TCS: EEATCS Overview: EEATCA(B) PFCS Nominal Commands: EEATCA(B) PFCS FDIR Commands
EEATCA(B) PFCS FDIR Commands
- **cmd** EEATCA(B) PFCS FCV Temp Recal FDIR Inh - Arm **Execute**
- **cmd** EEATCA(B) PFCS FCV Temp Recal FDIR - Inh **Execute**
- sel EEATCA(B) PFCS FDIR Additional Commands

EEATCA(B) PFCS FDIR Additional Commands
- √EEATCA(B) PFCS Max Out Temp FDIR - Inh

2
P6: TCS: EEATCS Overview: Loop A(B) PFCS Nominal Commands
Loop A(B) PFCS Nominal Commands
EEATCA(B) PFCS FCV Recal Status - Performing?

Yes → 3
Loop A(B) PFCS Nominal Commands
- Wait until EEATCA(B) PFCS FCV Recal Status - Not Performing

No

4
Loop A(B) PFCS Nominal Commands
EEATCA(B) FCV Cntl - Ena?

Yes → 5 PVCU is not controlling the FCV.

No

6
TCS Overview
PVCU Mode - Fully Commanded?

Yes → 10

No

8 All closed loop control and FDIR is disabled.

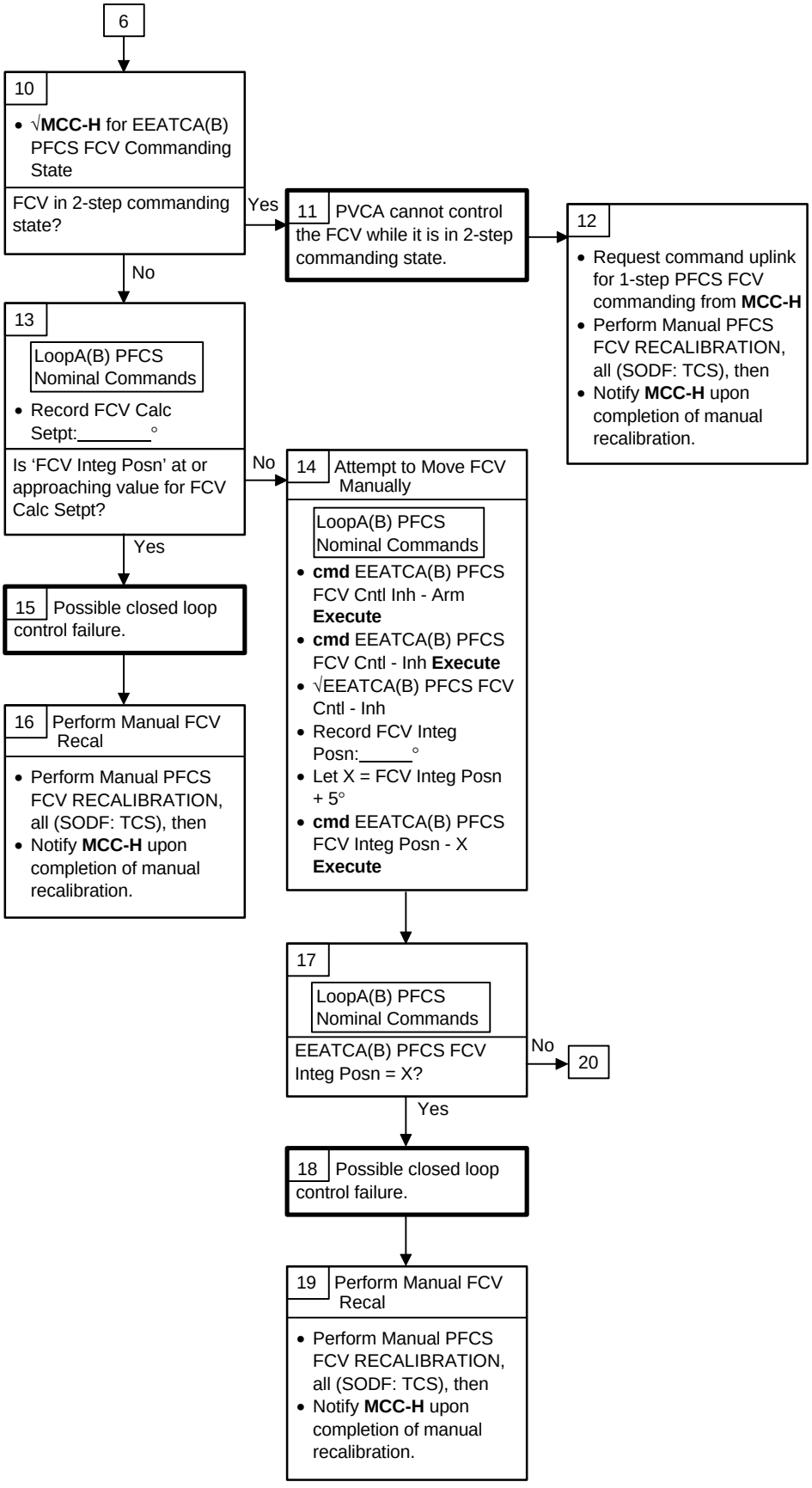
9
- √**MCC-H** concerning EEATCS Loop A(B) manual control and manual recalibration.

7
Loop A(B) PFCS Nominal Commands

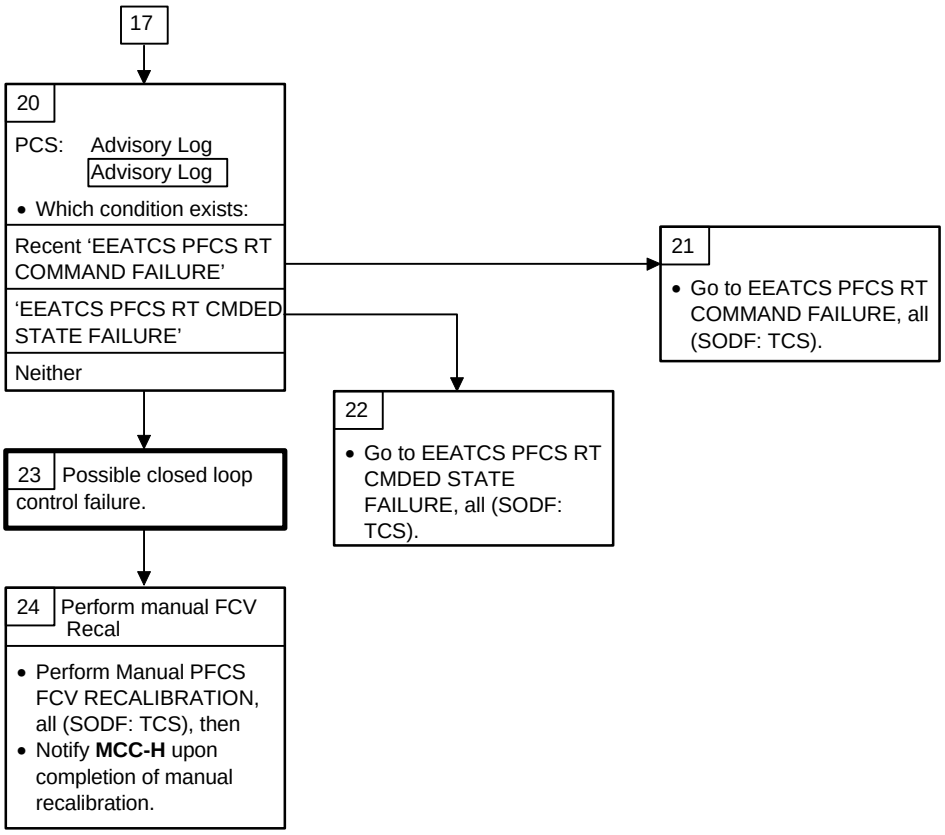
On MCC-H GO
- **cmd** EEATCA(B) PFCS FCV Cntl Ena - Arm **Execute**
- **cmd** EEATCA(B) PFCS FCV Cntl Ena - Arm **Execute**
- √**MCC-H** for FCV recal instructions

(1)
The FCV calibration failure could cause a 'PFCS Max Out Temp Violation' warning message. The FDIR for this violation is nominally inhibited. Upon receipt of this warning, contact **MCC-H** to see if any immediate corrective action is necessary.

EEATC PFCS FCV RECAL FAILURE (Cont)



EEATC PFCS FCV RECAL FAILURE (Cont)



EEATC PFCS INVALID DATA CONDITION

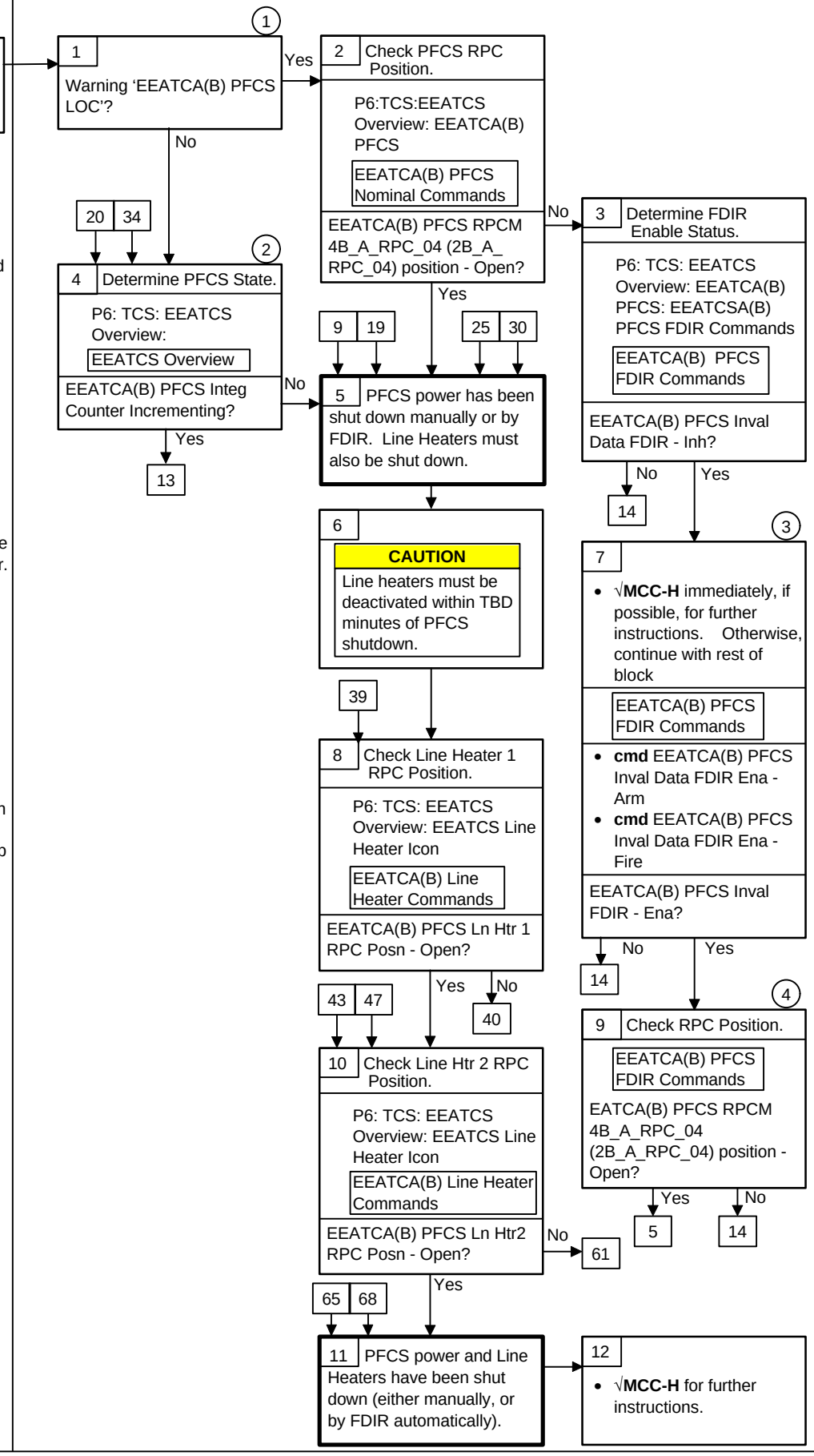
Warning: EEATCA(B) PFCS Invalid Data Condition

Message is initiated if both the EEATCA(B) PFCS Out Filtrd Lwr Temp and the EEATCA(B) PFCS Out Line Filtrd Temp are invalid

Nominal Config: Normally the EEATCS PFCS Invalid Data FDIR will be enabled. For the Invalid Data Condition, the loop has no valid control temperature sensor and no valid Out Line Temperature Sensor. Activation of this FDIR deactivates flow and Line Heaters in the affected loop by opening:

1) the RPC associated with the affected PFCS

2) the RPC associated with each line heater on the affected EEATC loop



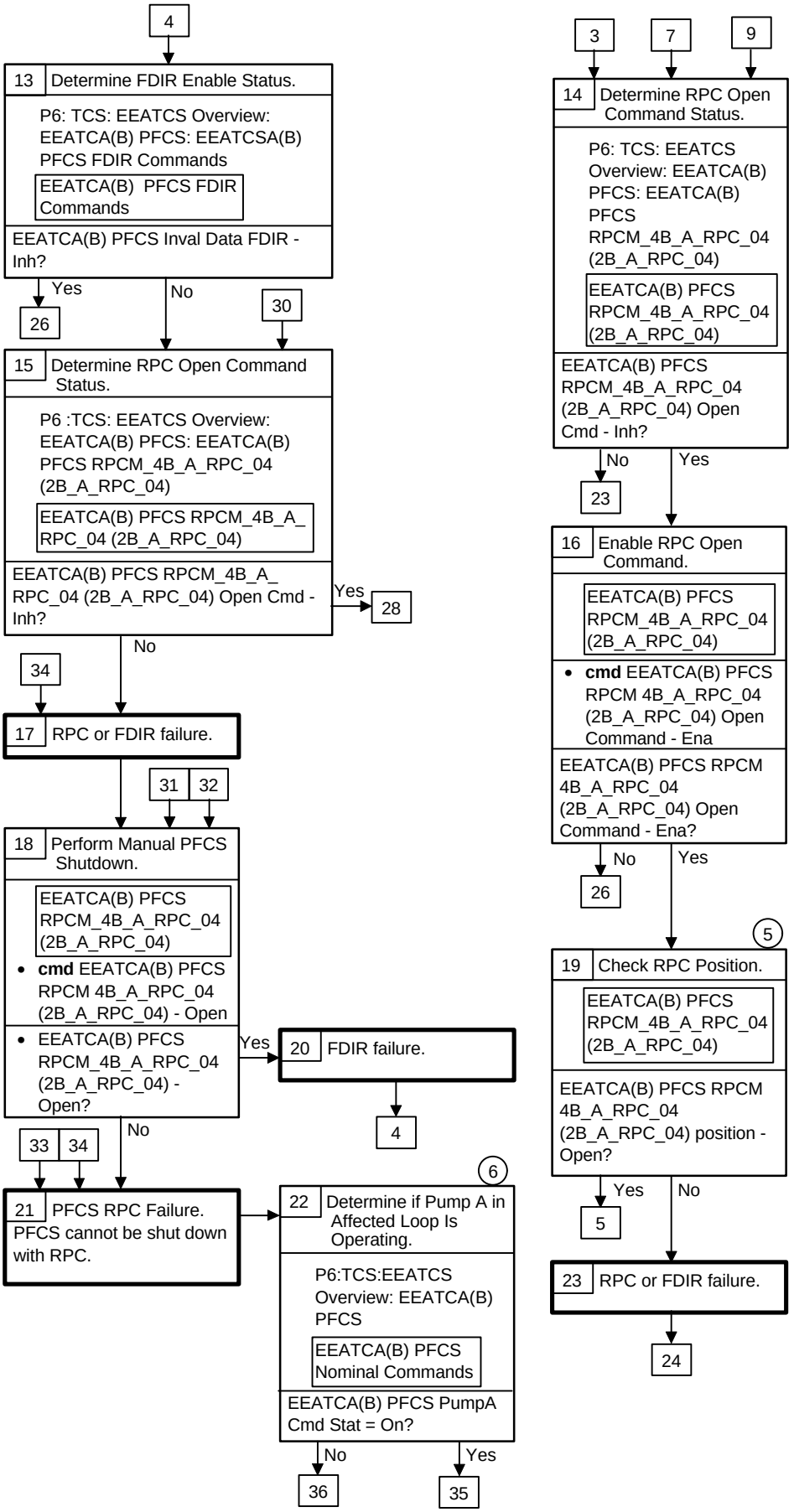
1 If this condition is caused in part by a message 'PFCS LOC', the option of commanding the pumps off is not available in the event the PFCS cannot be shut down.

2 If the integration counter is still incrementing, the FDIR has not effected PFCS shutdown and the loop is still operating with no temperature control.

3 FDIR would normally be enabled. If it is not, the reason for this should be determined, if possible. If the **MCC-H** cannot be reached immediately, proceed to enable the FDIR because the loop is operating with no temperature control.

4 Enable FDIR should cause the PFCS RPC to be open.

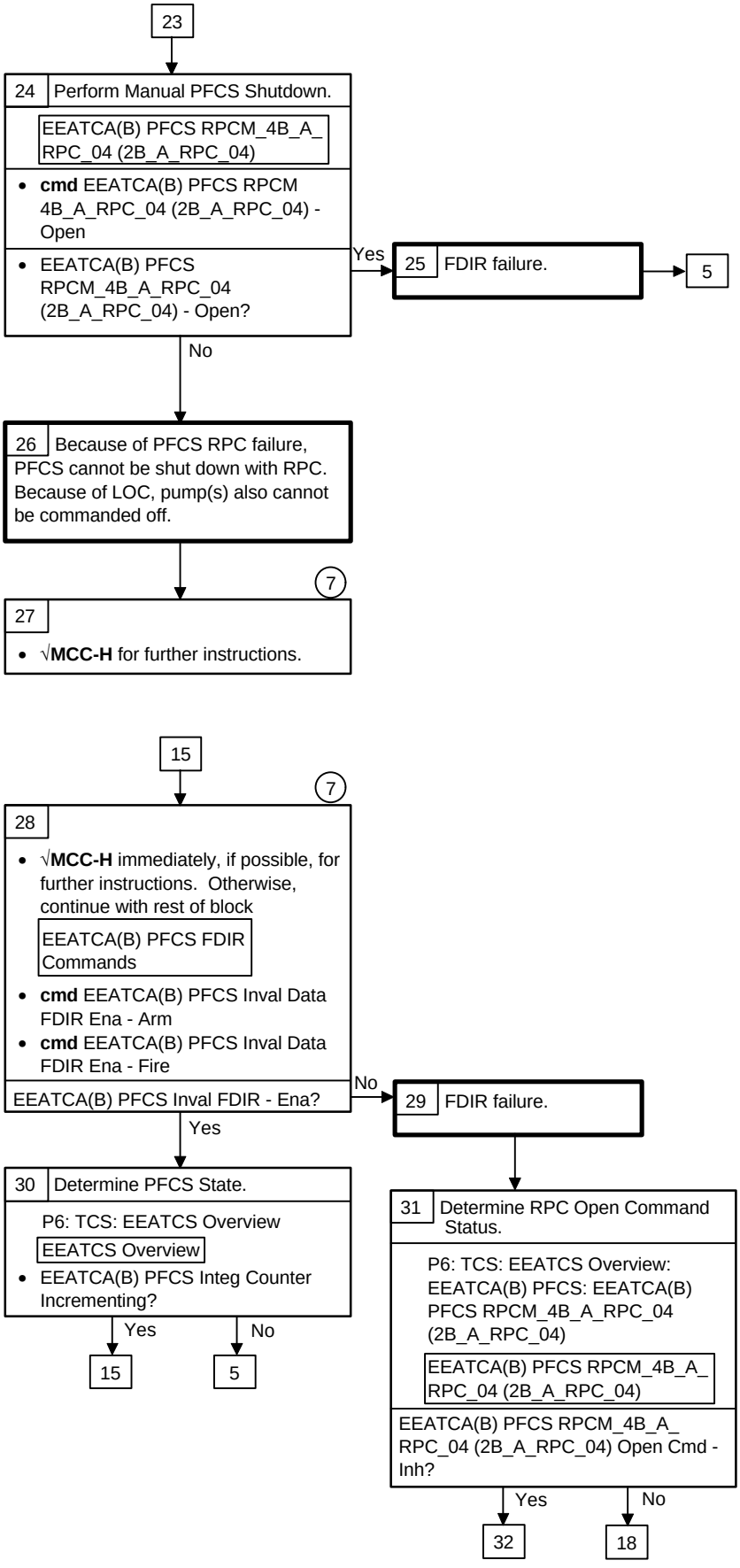
EEATC PFCS INVALID DATA CONDITION (Cont)



(5) Once the PFCS RPC open command is enabled, the FDIR should cause the RPC to open. If this block has been entered from a leg in which the FDIR could not be enabled, the answer to this block will just be 'no'.

(6) Although PFCS cannot be shut down with the RPC, the pump(s) can be commanded off.

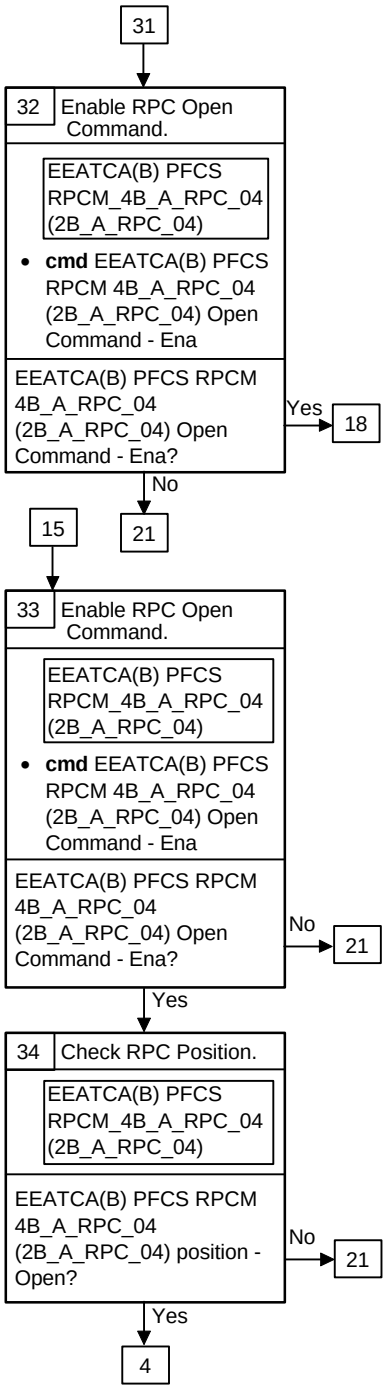
EEATC PFCS INVALID DATA CONDITION (Cont)



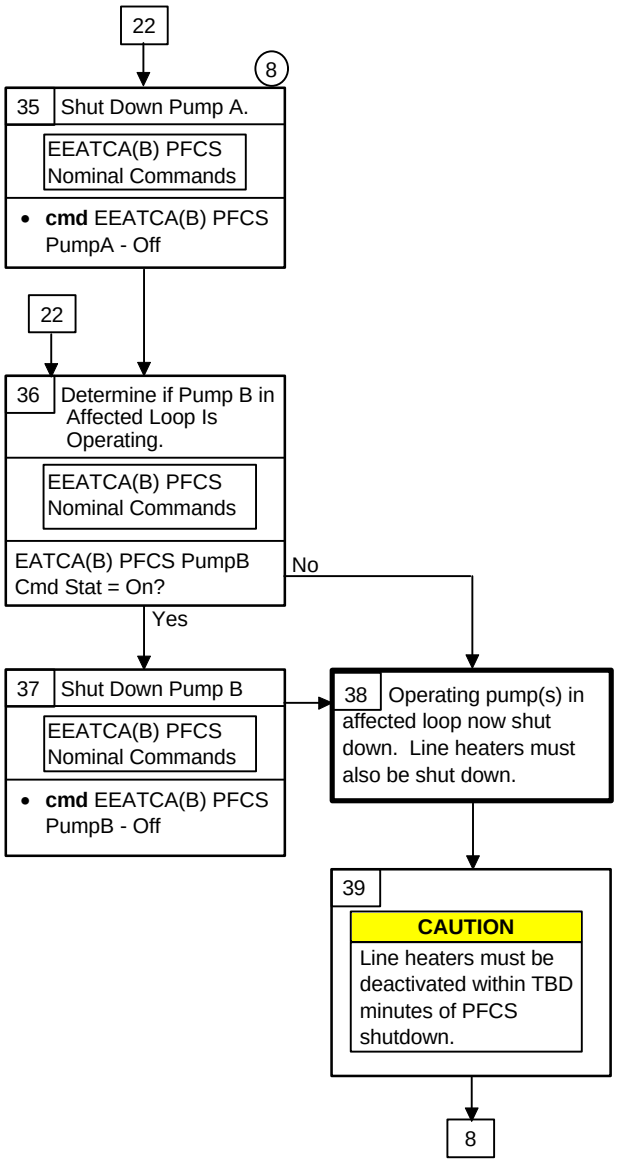
(3)
FDIR would normally be enabled. If it is not, the reason for this should be determined, if possible. If the **MCC-H** cannot be reached immediately, proceed to enable the FDIR because the loop is operating with no temperature control.

(7)
MCC-H will decide what option(s) should be pursued (unpowering PFCS upstream of RPC, selecting the other out line temperature sensor for insight and continuing to operate the loop uncontrolled, etc.).

EEATC PFCS INVALID DATA CONDITION (Cont)

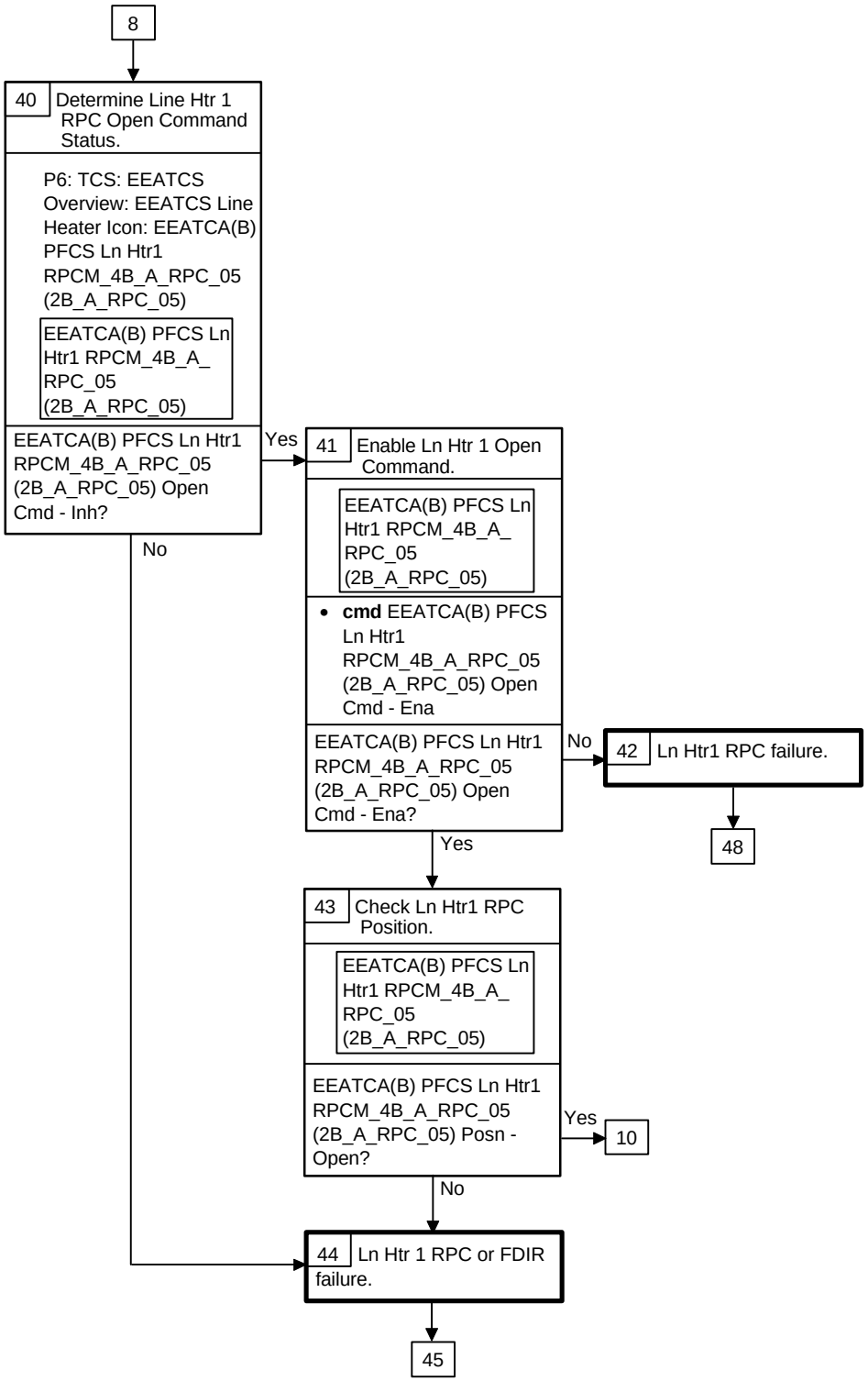


EEATC PFCS INVALID DATA CONDITION (Cont)

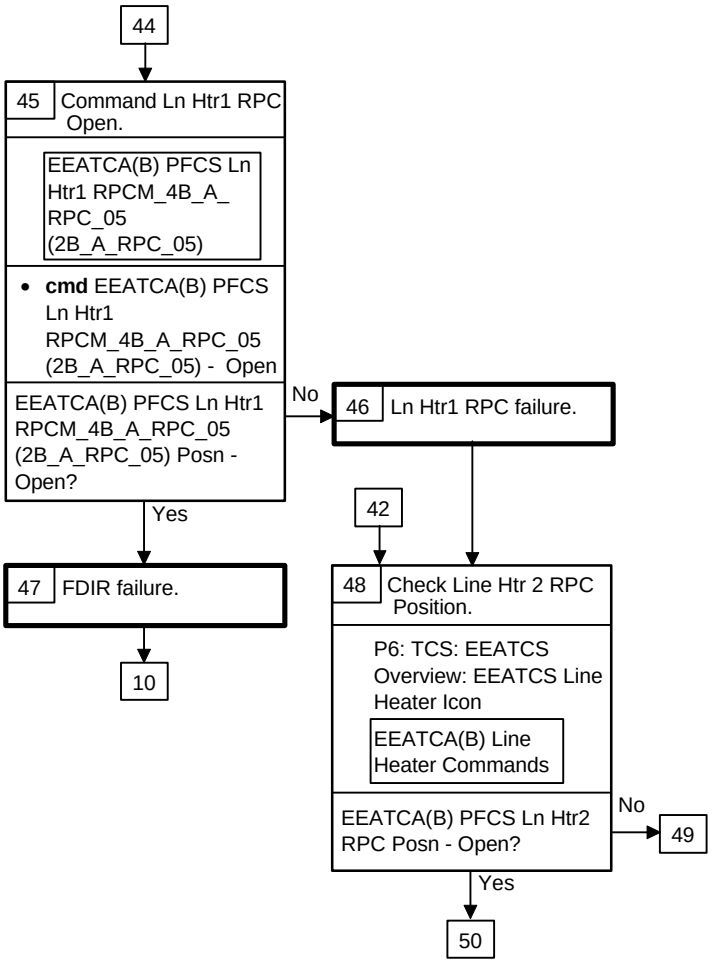


(8) Enough failures have occurred to this point that we will not consider being unable to shut off the pump as credible.

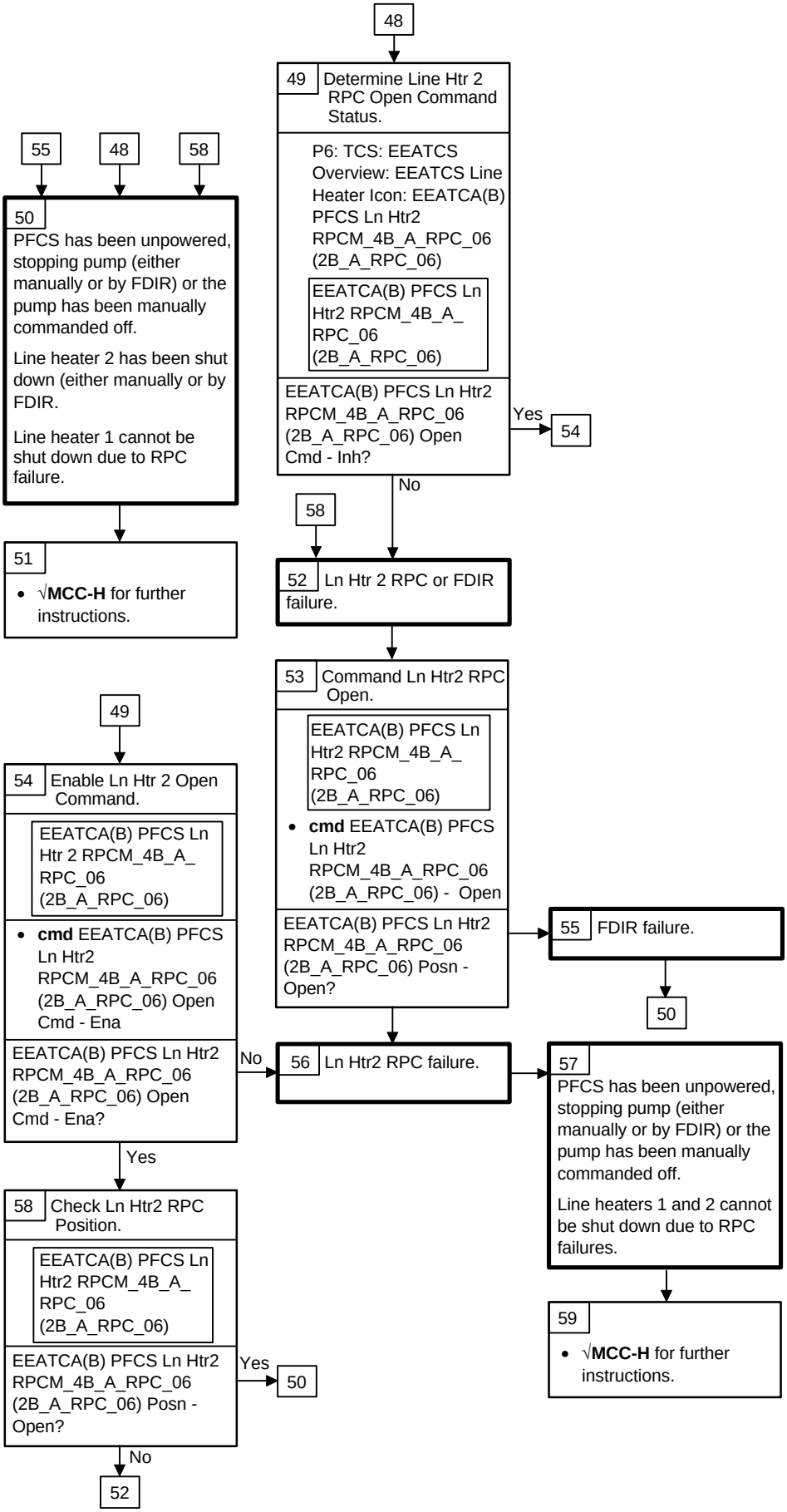
EEATC PFCS INVALID DATA CONDITION (Cont)



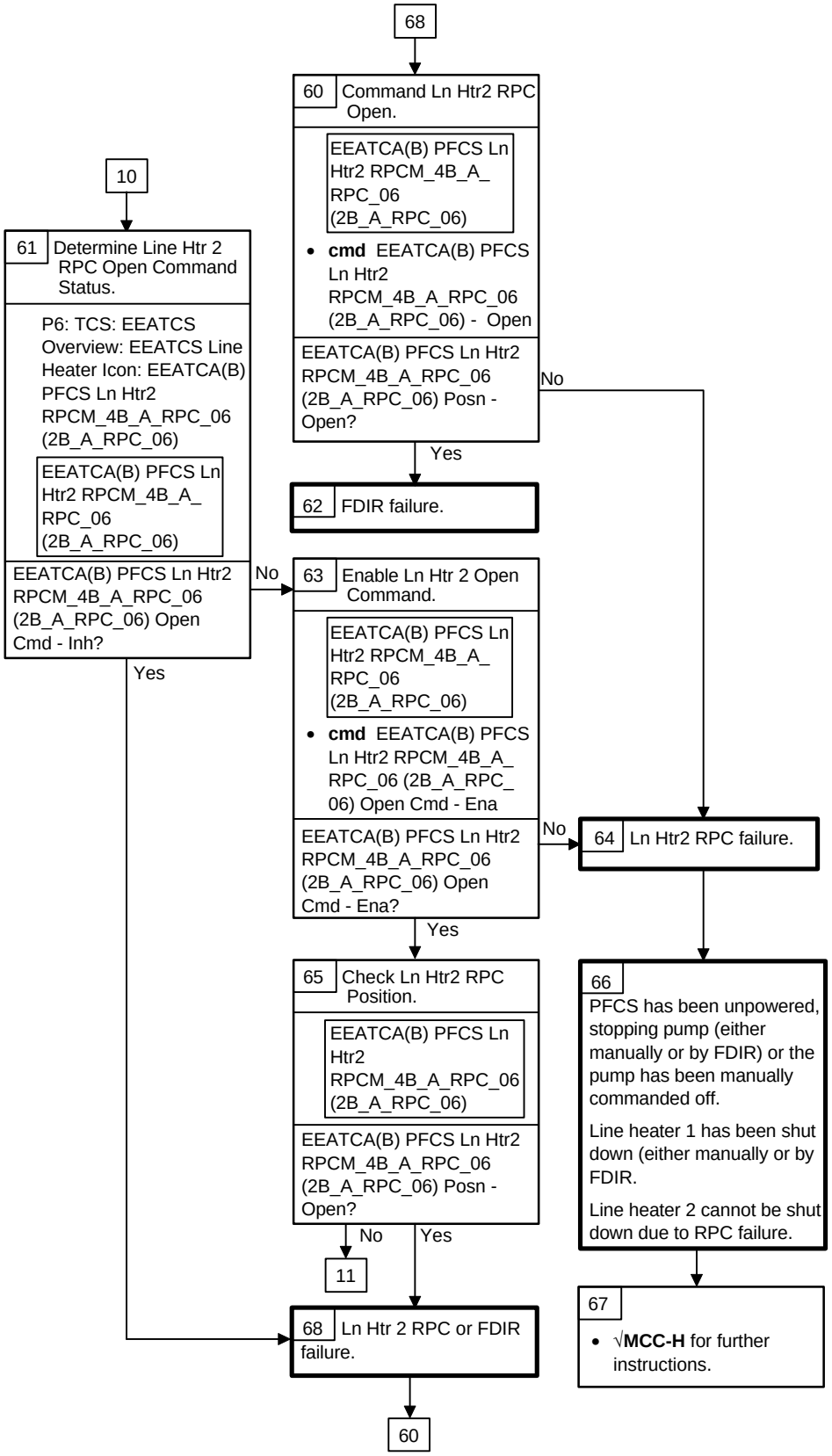
EEATC PFCS INVALID DATA CONDITION (Cont)



EEATC PFCS INVALID DATA CONDITION (Cont)



EEATC PFCS INVALID DATA CONDITION (Cont)



EEATC PFCS LOSS OF COMM

(1)

Warning:
EEATCS PFCS LOC

User Notification

PCS C&W Summary

PV_CWAI_ EEATCS_ PFCS_Loss_of_ Comm

PCS EEATCS (Telemetry): Telemetry Will Not Update.

1 Ensure Communication Loss Is Still in Effect.

PCS P6: TCS: EEATCS: Overview check EEATC PFCS Integ Counter

Is counter still incrementing?

Yes → **2** Temporary loss of comm with PFCS.

No

3 Attempt to Reset 1553 Chipset in LDI.

PCS P6: TCS: EEATCS: Loop A(B) Firmware

Loop A(B) Firmware

- cmd RT Reset arm
- cmd RT Reset fire
- Monitor command response for successful command execution

Did communication get reestablished?

Yes → **5** Possible SEU of 1553 chipset.

No

6 Issue Command to Reinitialize PFCS FWC.

PCS P6: TCS: EEATCS: Loop A(B) Firmware

Loop A(B) Firmware

- cmd FWC Reinit Arm
- cmd FWC Reinit Fire
- Monitor command response window and PFCS telemetry for return to default values.
- Wait approximately 10 seconds for response.

Was reset successful?

Yes → **8** Possible SEU of firmware controller.

No → 10

4

- Continue to monitor periodically to ensure problem does not persist. No action required.

(2)

7 Resume PFCS Operations.

- Check telemetry and command FCV back to radiator flow.

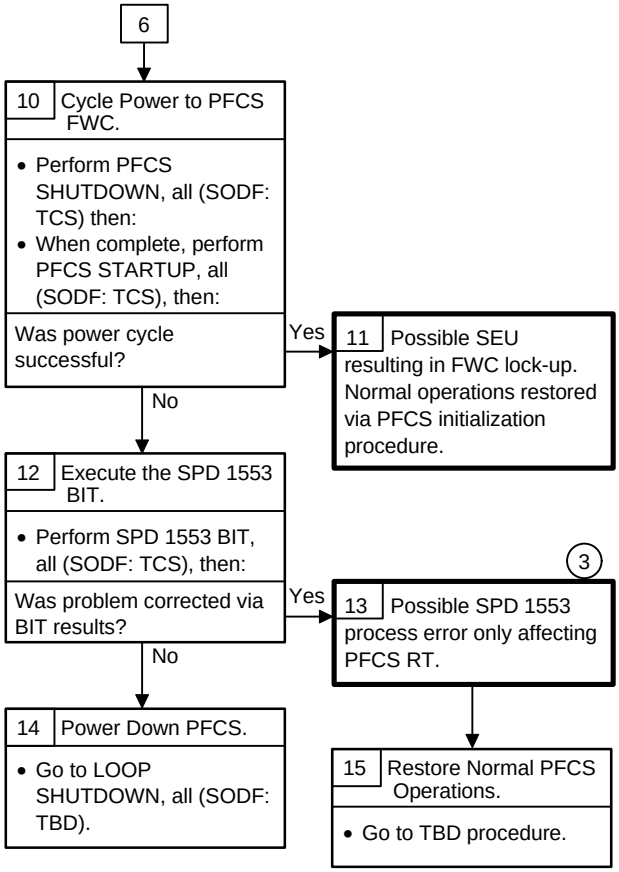
9 Resume PFCS Operations

- Check telemetry and command FCV back to radiator flow.

(1) PVCA issues this WARNING message as a result of 1553 FDIR capability to detect consecutive transaction errors specific to the PFCS RT. Loss of comm to all RTs will result in a bus failure message. The 1553 chipset will also continue to monitor the channel for valid data; and, if successful, will automatically clear the loss of comm condition. This prevents temporary conditions from upsetting processing.

(2) If FWC detects loss of comm, it will drive the FCV to its default position after 60 seconds. Upon PFCS startup, this default is full radiator bypass and can be commanded to a new default setting subsequently.

EEATC PFCS LOSS OF COMM (Cont)



(3) 1553 FDIR processing a LOC for only the PFCS is a sign of good SPD 1553 processing. If SPD 1553 has a problem, multiple RTs would likely have LOC which causes a bus failure declaration. BIT is conducted as a final assurance before powering off the PFCS but may interrupt communication to other RTs.

EEATC NH3 LINE HEATERS FAILED TO COME ON

CAUTION ALARM

Caution: EEATCS PFCS NH3 Line Heaters Failed to Come On

Alarm Limit:
EEATCA(B) PFCS Out Filtered Lower Temp ≤ 8.3°C (47°F)

Nominal Config
- 3.05°C (37.5°F) ≤ EEATCA(B) PFCS Out Filtered Lower Temp
- EEATCA(B) PFCS Line Htr Cntl - Ena

EEATCA(B) PFCS FCV Cntl - Ena

RPCM 4B(2B) A RPC 05 Close Cmd - Ena

RPC 06 Close Cmd - Ena

(1)

1
P6: TCS: EEATCS Overview
EEATCS Overview
Is EEATCA(B) PFCS Out Fltrd Lwr Temp > 3.05°C (37.5°F)?

Yes → **2** Transient thermal environment.

3
- Monitor EEATCA(B) PFCS Out Fltrd Lwr Temp
- Continue nominal operations.

No

4
P6: TCS: EEATCS Overview: EEATCA(B) Line Heater Icon
EEATCA(B) Line Heater Commands
EEATCA(B) PFCS Line Htr Cntl - Ena?

Yes → **5** Line Heater control not active.

6
EEATCA(B) Line Heater Commands
On MCC-H GO
- **cmd** EEATCA(B) PFCS Line Htr Cntl Ena - Arm **Execute**
- **cmd** EEATCA(B) PFCS Line Htr Cntl Ena - Fire **Execute**
- √EEATCA(B) PFCS Line Htr Cntl - Ena

No

7
P6: TCS: EEATCS Overview
EEATCS Overview
EEATCA(B) PFCS FCV Integ Posn < 72°?

No → **8** FCV position out-of-range for heater operation. Possible FCV commanding problem or hardware malfunction.

Yes

(1)

9
P6: TCS: EEATCS Overview: EEATCA(B) PFCS: EEATCA(B) PFCS FDIR Commands
EEATCA(B) PFCS FDIR Commands
- √EEATCA(B) PFCS Min Out Temp FDIR - Ena
- √**MCC-H** concerning FCV Control problems

10
P6: TCS: EEATCS Overview: EEATCA(B) Line Heater Icon: RPCM 4B(2B) A RPC 05
RPCM 4B(2B) A RPC 05
- Which condition exists:

RPCM 4B(2B) A RPC 05 Close Cmd - Inh → **11** RPC out of nominal config. → **12**
- √**MCC-H** concerning removal of RPC close inhibit.

RPCM 4B(2B) A RPC 05 Posn Stat - Tripped → **13**
- Perform RPCM LOSS OR TRIPPED MAL, all (SODF: EPS), then

RPC Recovered?

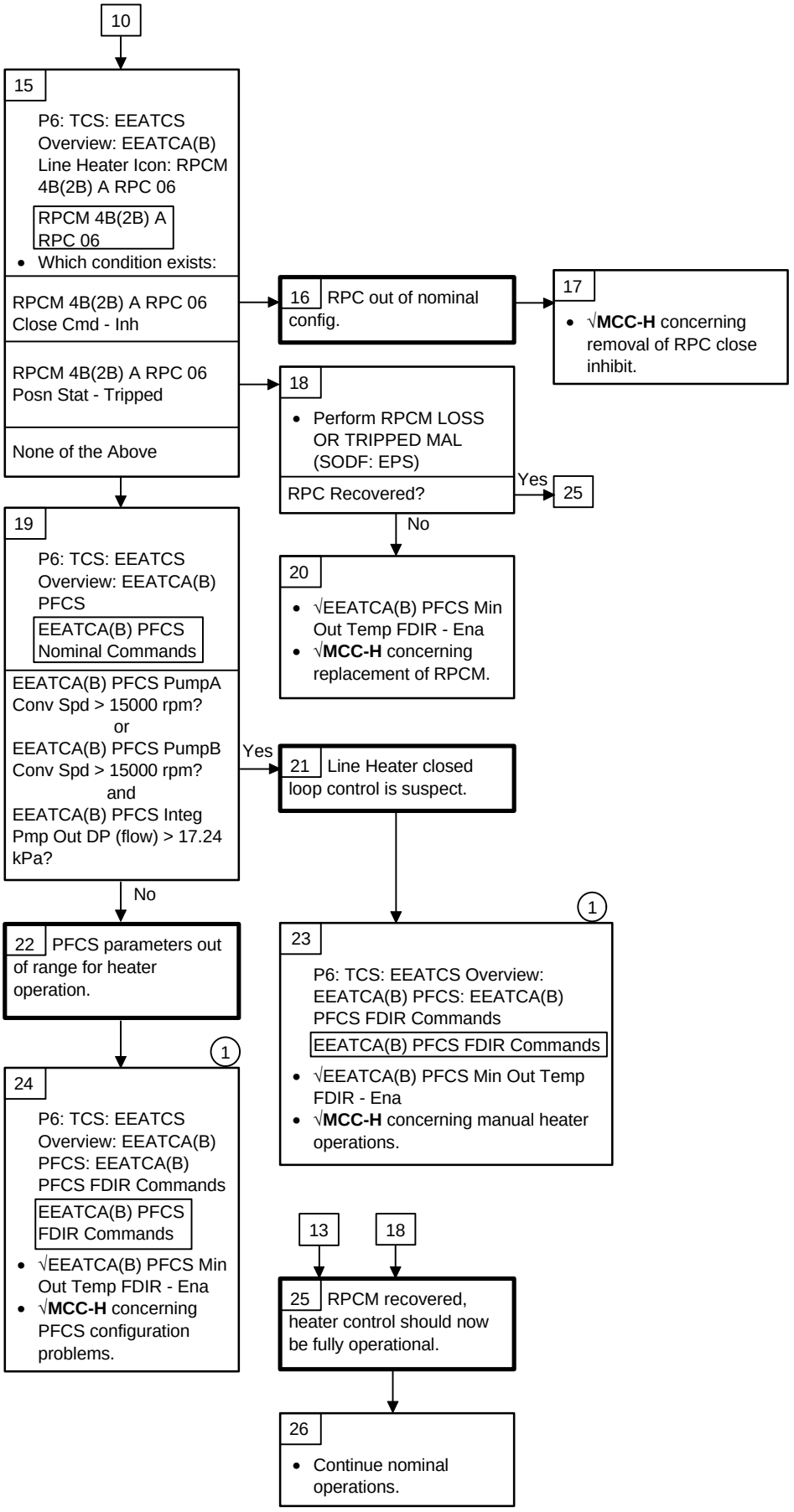
No → (1) **14**
- √**MCC-H** concerning replacement of RPCM.
- √EEATCA(B) PFCS Min Out Temp FDIR - Ena

Yes → **25**

None of the Above → **15**

(1) Because of the line heaters failing to come on, there is a danger of undertemping the affected EEATCS loop. Be prepared for possible 'PFCS Min out temp' warning message and associated FDIR algorithms. If this message occurs, proceed immediately to the EEATCS Undertemp malfunction procedure (SODF: TCS).

EEATC NH3 LINE HEATERS FAILED TO COME ON (Cont)



(1) Because of the line heaters failing to come on, there is a danger of undertemping the affected EEATCS loop. Be prepared for possible 'PFCS Min out temp' warning message and associated FDIR algorithms. If this message occurs, proceed immediately to the EEATCS Undertemp malfunction procedure (SODF: TCS).

EEATC PFCS OVERTEMP CONDITION

Warning: EEATCA(B) PFCS Fluid Leak Condition

Alarm Limit:
EEATCA(B) PFCS Out Filtered Lower Temp ≥ 8.3°C (47°F)

Nominal Config
1.7°C (35°F) ≤ EEATCA(B) PFCS Out Filtered Lower Temp ≤ 8.3°C (47°F)

EEATCA(B) PFCS FCV Temp Recal FDIR - Inh

EEATCA(B) PFCS FCV Cntl - Ena

1 Check FCV FDIR Algorithm.

P6: TCS: EEATCS Overview: Loop A(B) PFCS Nominal Commands: Loop A(B) PFCS FDIR Commands

Loop A(B) PFCS FDIR Commands

- √EEATCA(B) FCV Temp Recal FDIR - Inh
- sel EEATCA(B) PFCS Nominal Commands

Loop A(B) PFCS Nominal Commands

- √EEATCA(B) FCV Cntl - Ena

EEATCA(B) PFCS FCV Recal Status - Performing?

Yes → **2**

Loop A(B) PFCS Nominal Commands

- Wait until EEATCA(B) PFCS FCV Recal Status - Not Performing

EEATC Loop A(B) PFCS Out Fltrd Lwr Temp < 8.3°C (47°F)?

No → **3** FCV calibration failure. PVCA FCV Control is suspect.

→ 1

Yes → 41

No → **4**

TCS Overview

PVCU Mode - Fully Commanded?

No → **6** All Closed loop control and FDIR are disabled.

Yes → **7** Check Validity of Overtemp Condition.

P6: TCS: EEATCS Overview

EEATCS Overview

EEATC Loop A(B) PFCS Out Fltrd Lwr Temp < 8.3°C (47°F)?

Yes → **9** Possible transient hot thermal environment.

No → **11** Check Heater RPC Position.

P6: TCS: EEATCS Overview: Loop A(B) PFCS Line Heater Icon

EEATCA(B) PFCS Line Heater Commands

- Which condition exists:

RPCM 4B(2B) A RPC 05 Posn - Cl → 12

RPCM 4B(2B) A RPC 06 Posn - Cl → 18

None of the above → 26

8

- √**MCC-H** concerning EEATCS Loop A(B) manual control.

5

- Perform FCV RECAL FAILURE MALFUNCTION, all (SODF: TCS), then
- √**MCC-H** for possibility of EEATCS overtemp response.

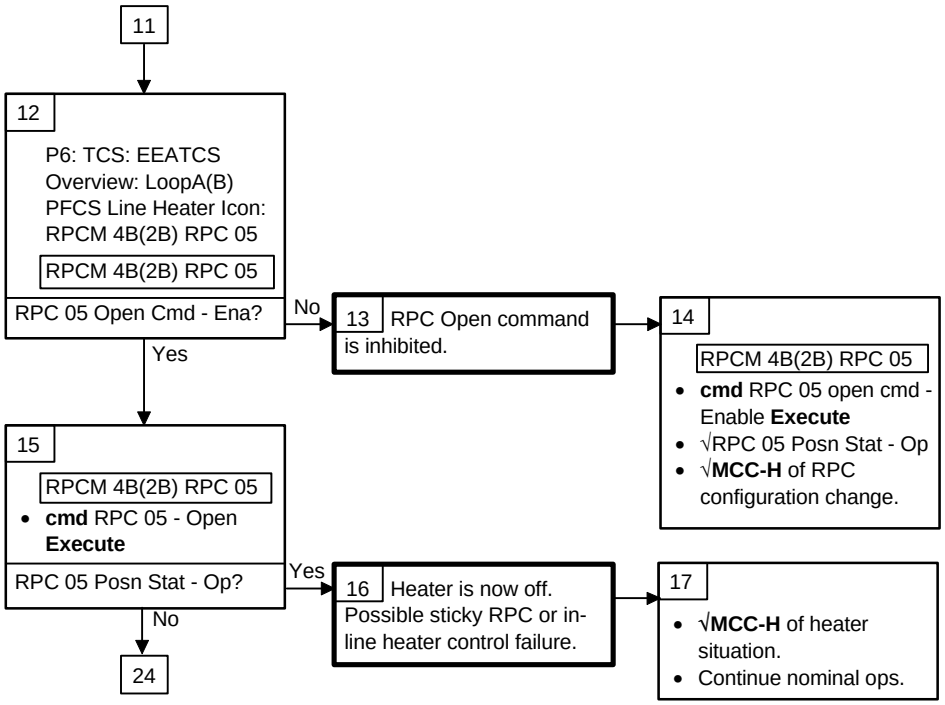
10

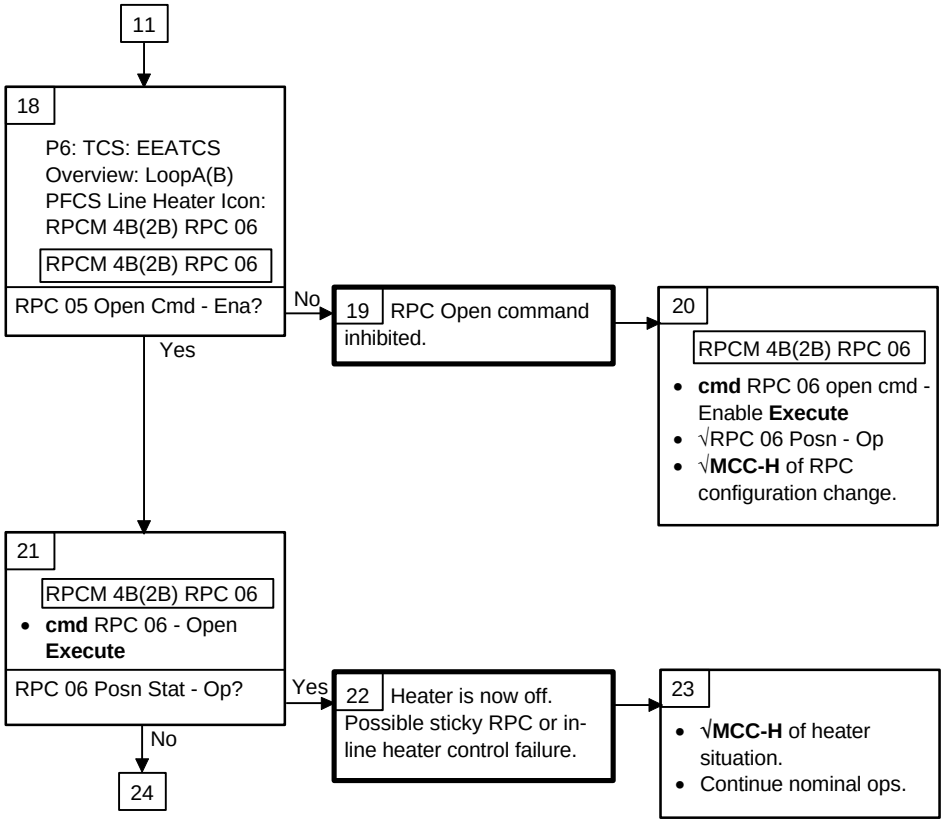
EEATCS Overview

- Monitor EEATC Loop A(B) PFCS Out Fltrd Lwr Temp
- Continue nominal operations.

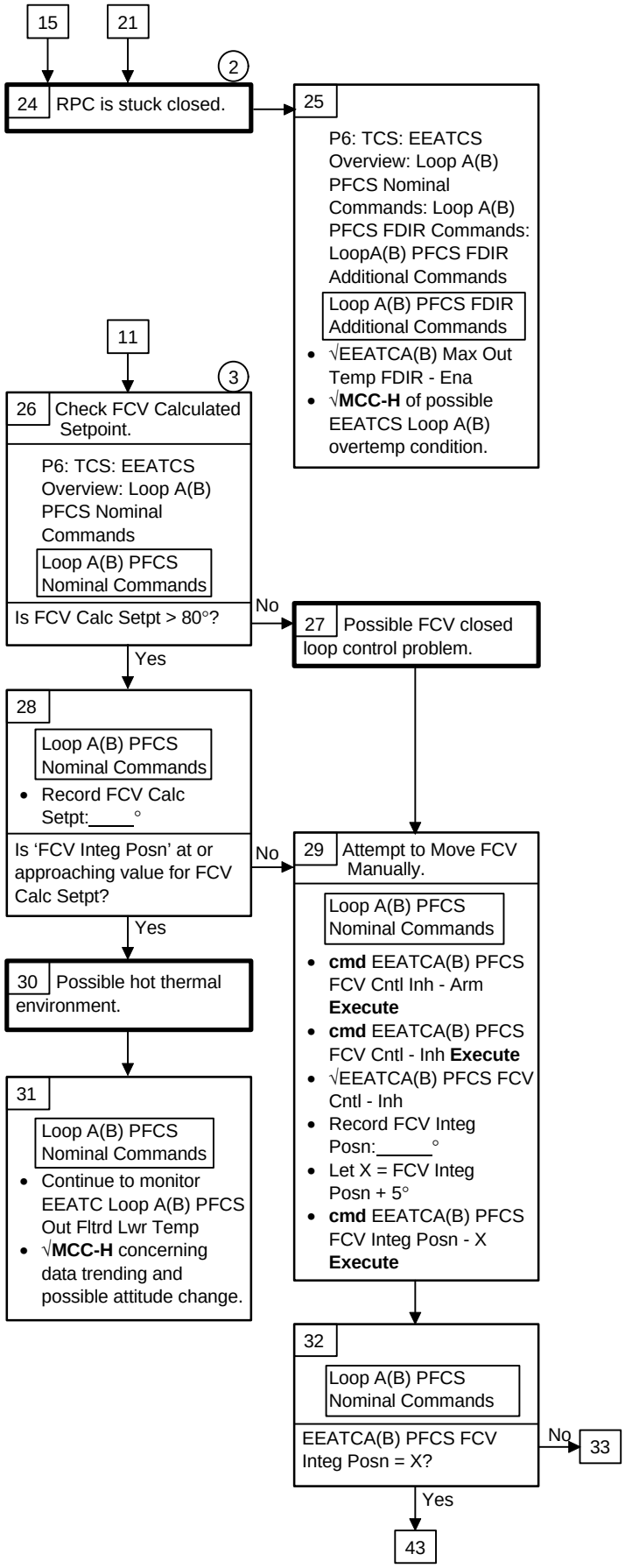
(1) PFCS FCV automatic recalibration has failed to resolve the FCV overtemp condition. Expect 'PFCS FCV Recal Failure' warning message.

EEATC PFCS OVERTEMP CONDITION (Cont)





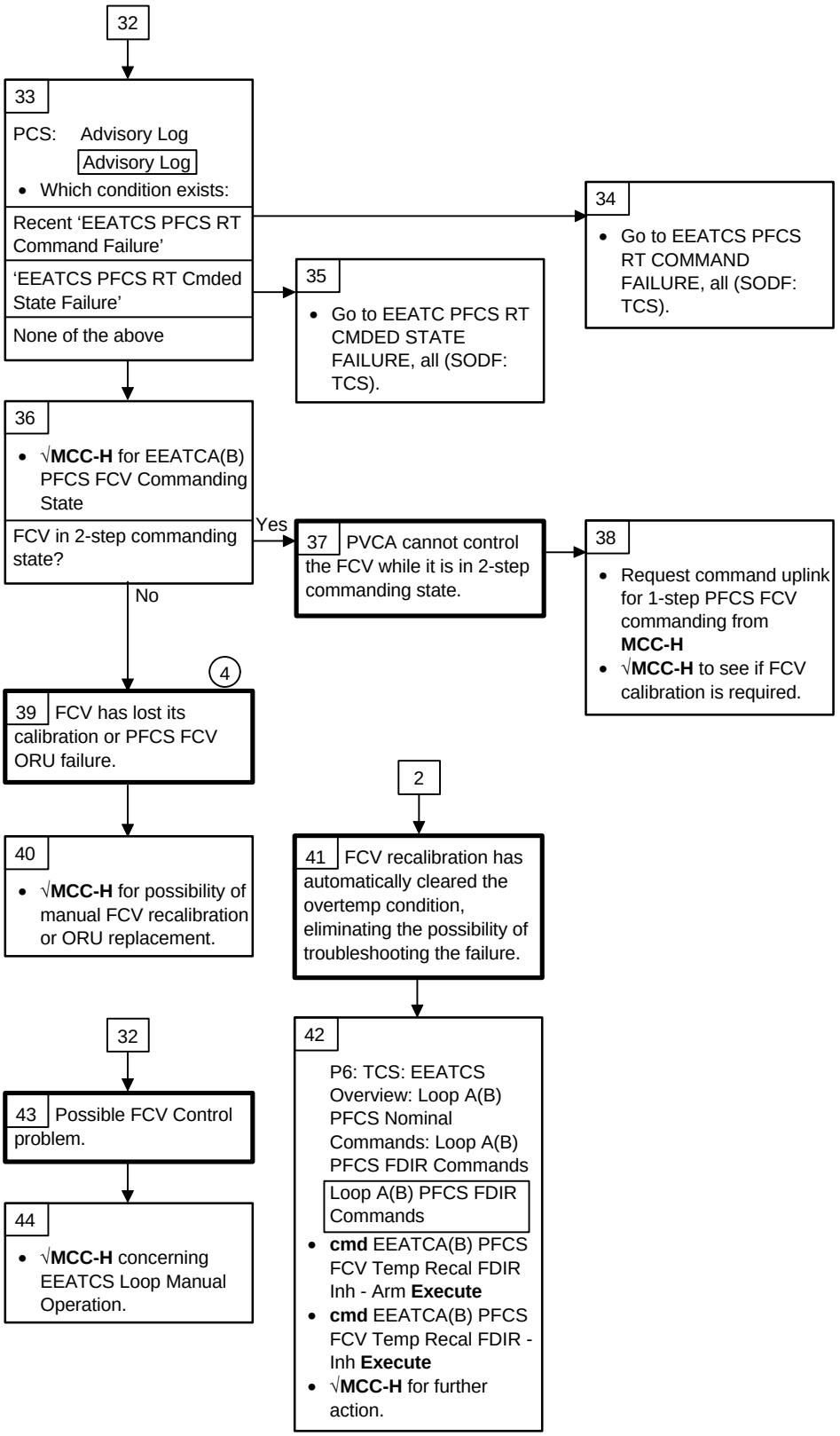
EEATC PFCS OVERTEMP CONDITION (Cont)



(2) NH3 In-line heater failure could cause a 'PFCS Max Out Temp Violation' warning message.

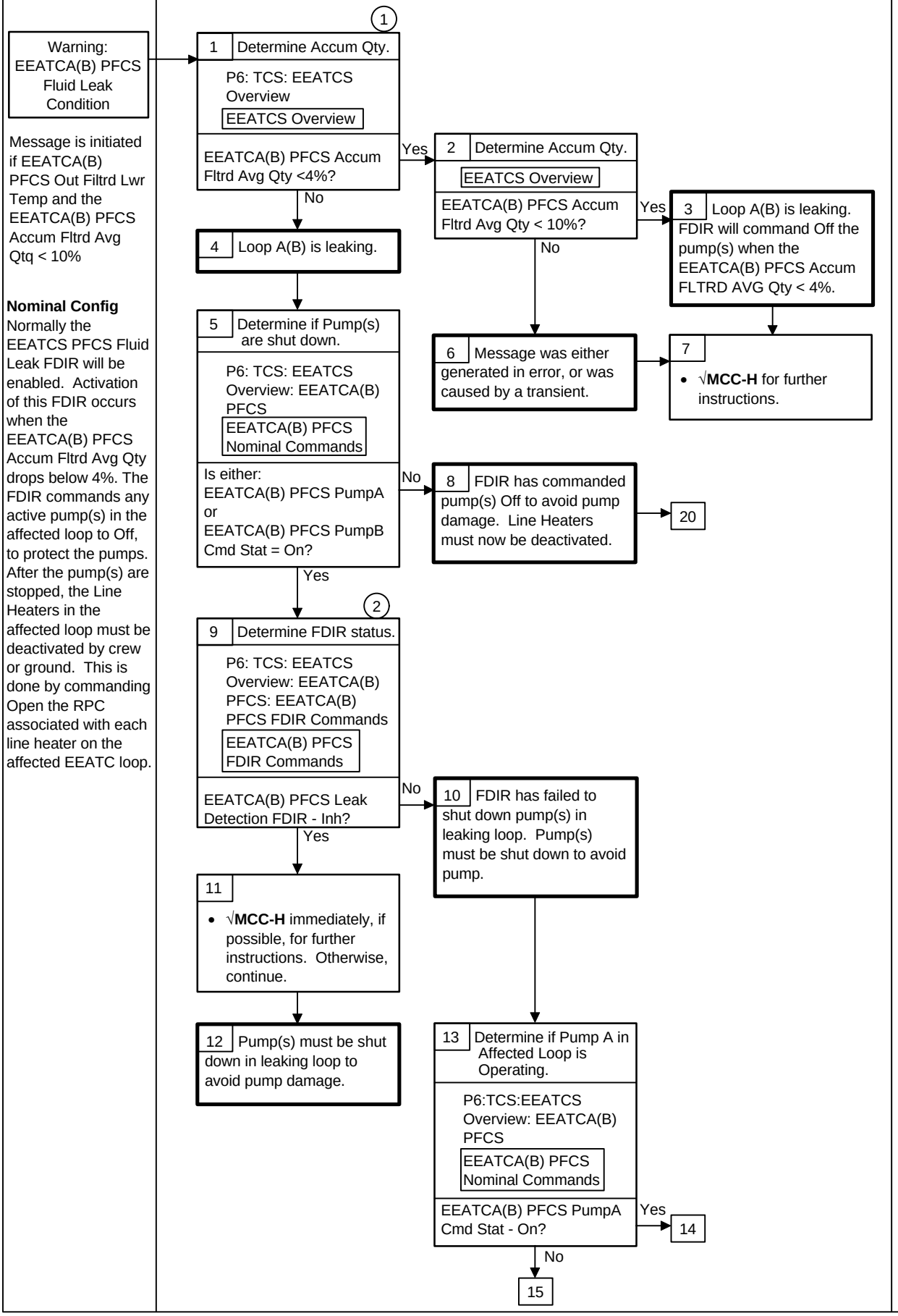
(3) The FCV Full radiator flow position is 90°. If the FCV Calculated setpoint is 80° or higher, the FCV control algorithm is attempting to drive the FCV to a cooler position. This indicates the control algorithm is working properly.

EEATC PFCS OVERTEMP CONDITION (Cont)



(4) The FCV calibration or ORU failure could lead to an 'EEATCA(B) PFCS Max Out Temp violation' warning message.

EEATC PFCS FLUID LEAK CONDITION



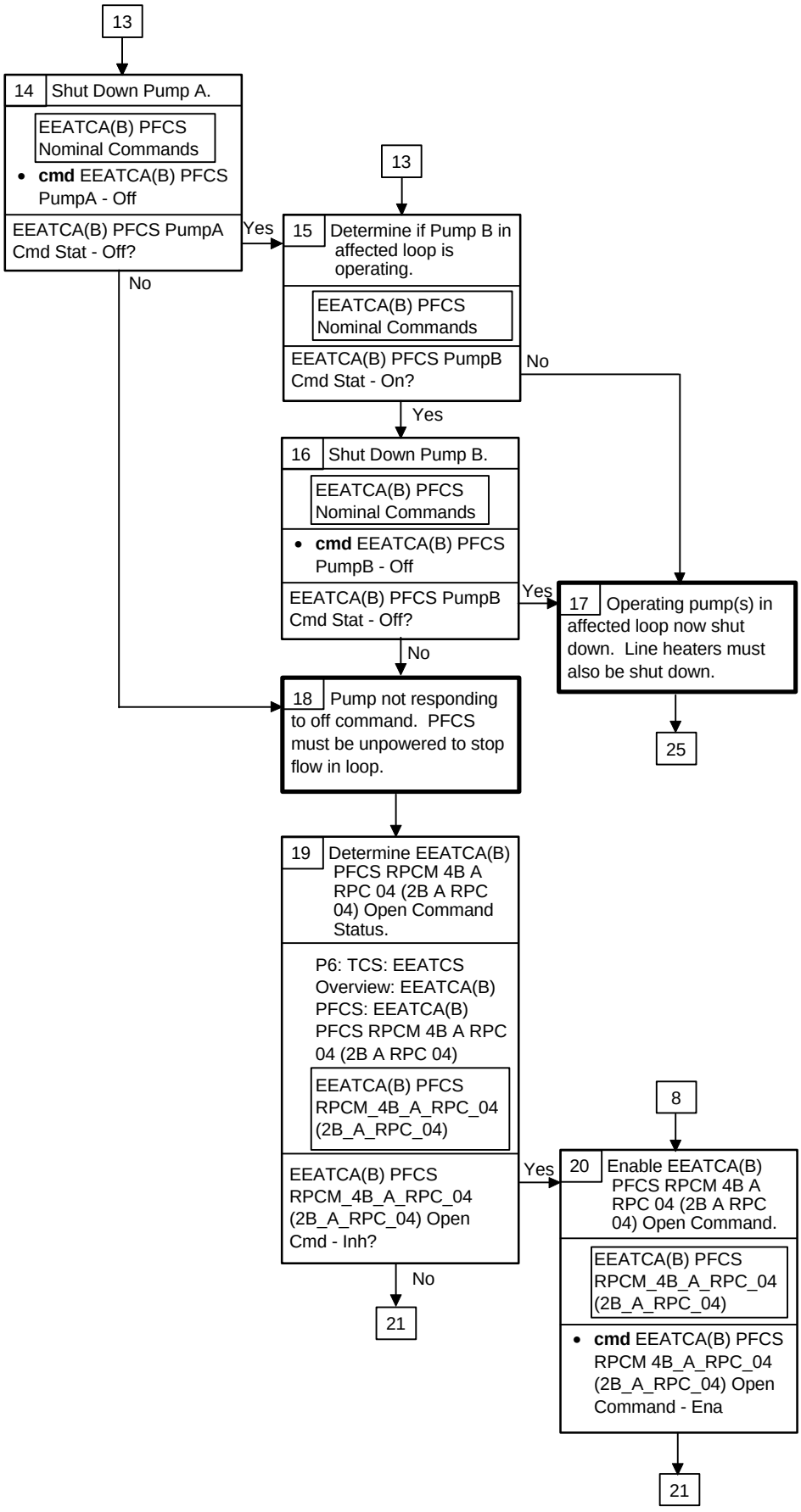
(1) If EEATCA(B) PFCS ACCUM Fltrd Avg Qty < 4% FDIR will command the pump(s) Off to protect pump(s).

(2) Inhibit/Enable status of FDIR must be known to know if FDIR has failed.

(3) MCC will know why FDIR is inhibited and will advise whether to continue with shutting down the pumps. If **MCC-H** cannot be reached, conservative action is to shut down the pump(s).

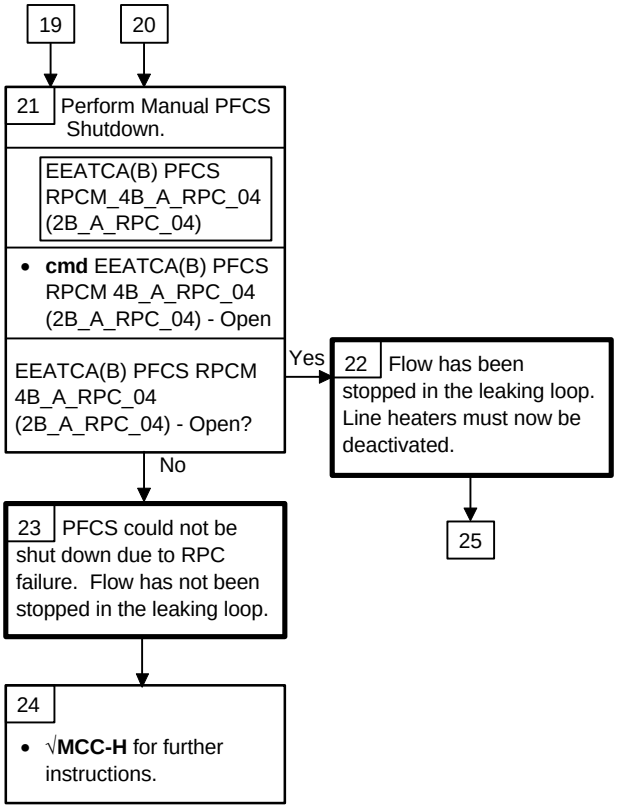
(4) **MCC-H** will assess rate of leak and length of time before pump(s) should be shut down. **MCC-H** will advise time and block number to reenter procedure.

EEATC PFCS FLUID LEAK CONDITION (Cont)

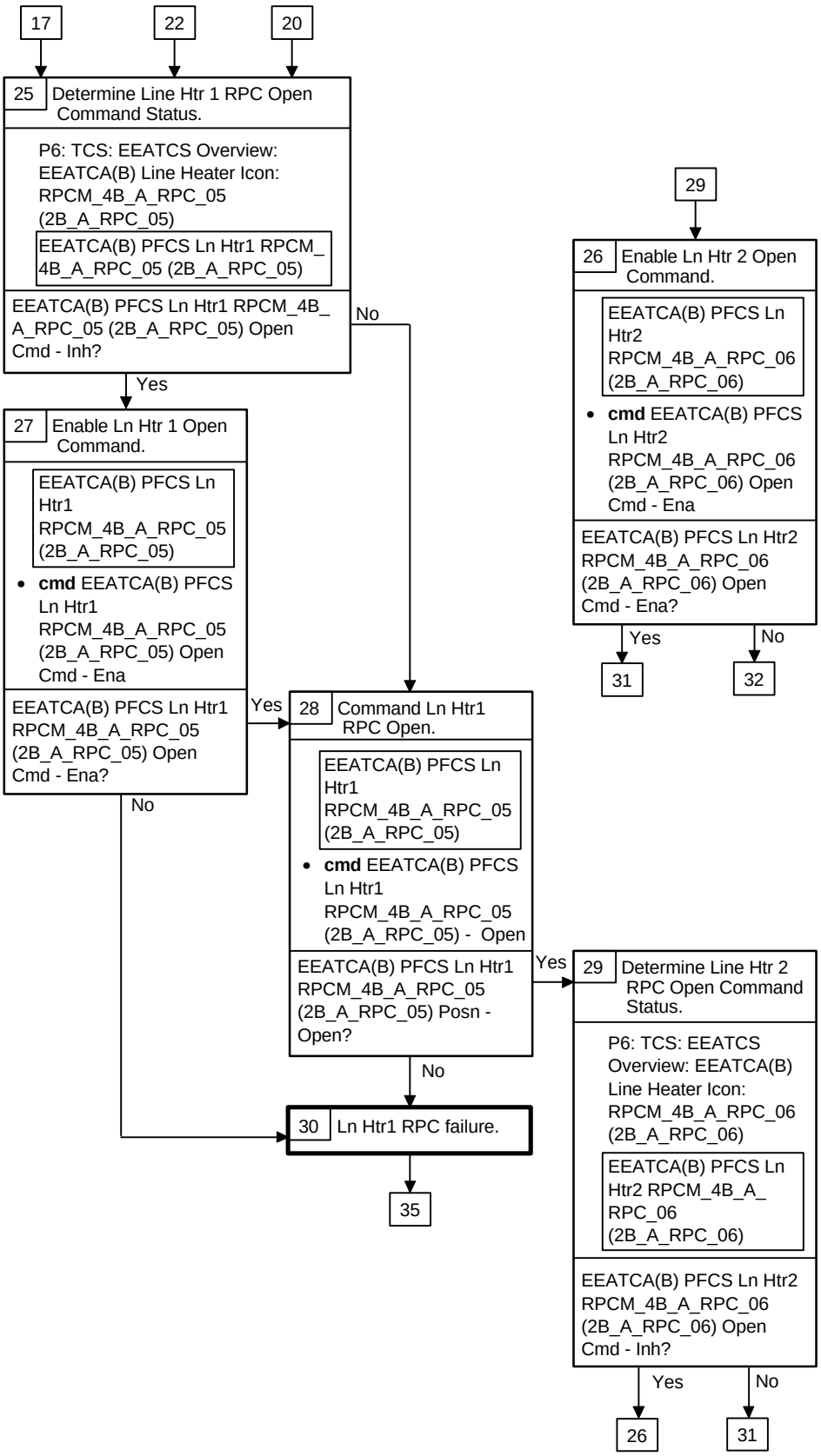


(5)
MCC-H will determine what option(s) should be pursued, including unpowering the PFCS upstream of the RPC.

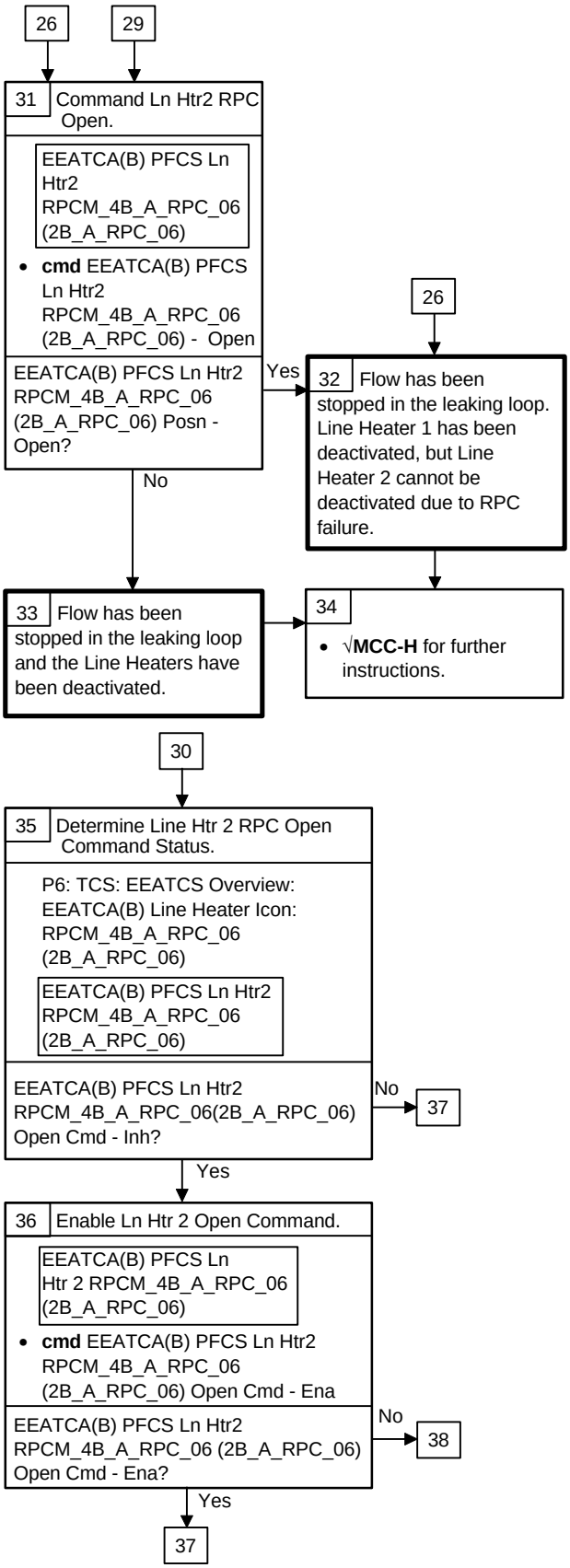
EEATC PFCS FLUID LEAK CONDITION (Cont)



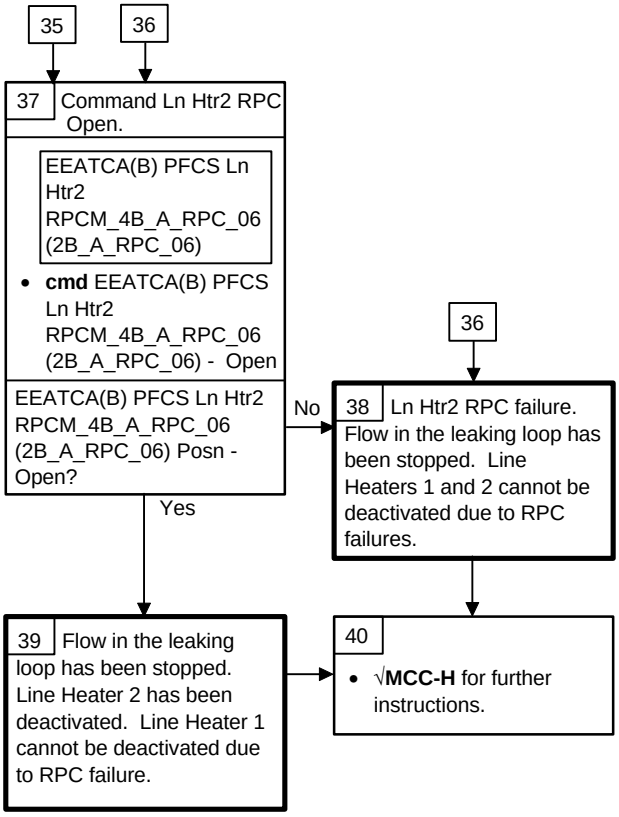
EEATC PFCS FLUID LEAK CONDITION (Cont)



EEATC PFCS FLUID LEAK CONDITION (Cont)



EEATC PFCS FLUID LEAK CONDITION (Cont)



EEATC PFCS ORU FAILURE

(1)
Warning:
EEATCS PFCS
ORU Failure

User Notification
PCS C&W Summary

PV_CWAI_EEATCS_
PFCS_ORU_Failure

1 Verify RPC Status.

PCS P6: TCS:
EEATCS: Loop A(B)
PFCS Nominal
Commands:
LoopA(B) PFCS
Nominal Commands

EEATC Loop A(B) PFCS RPC Posn = Op?

Yes → **2** Power lost to PFCS.

3
- √**MCC-H** for possible reset of RPC.

No

4 Verify DDCU Status.

PCS P6: TBD

P6 PVCU-PRI PV CW DDCU Trip?

Yes → **5** Power lost to PFCS.

6
- √**MCC-H** for possible reset of DDCU.

No

7 Verify Data Validity.

PCS P6: TCS: EEATCS:
Loop A(B)
PFCS Nominal
Commands: Loop
A(B) Val Ind
Loop A(B) Val Ind

Valid Indicators = Invalid?

Yes → TBD

No

8 Issue Command to Reinitialize PFCS FWC.

PCS P6: TCS: EEATCS:
Loop A(B) Firmware
Loop A(B) Firmware

- **cmd** FWC Reinit Arm
- **cmd** FWC Reinit Fire
- Monitor command response window and PFCS telemetry for return to default values.
- Wait approximately 10 seconds for response.

Was reset successful?

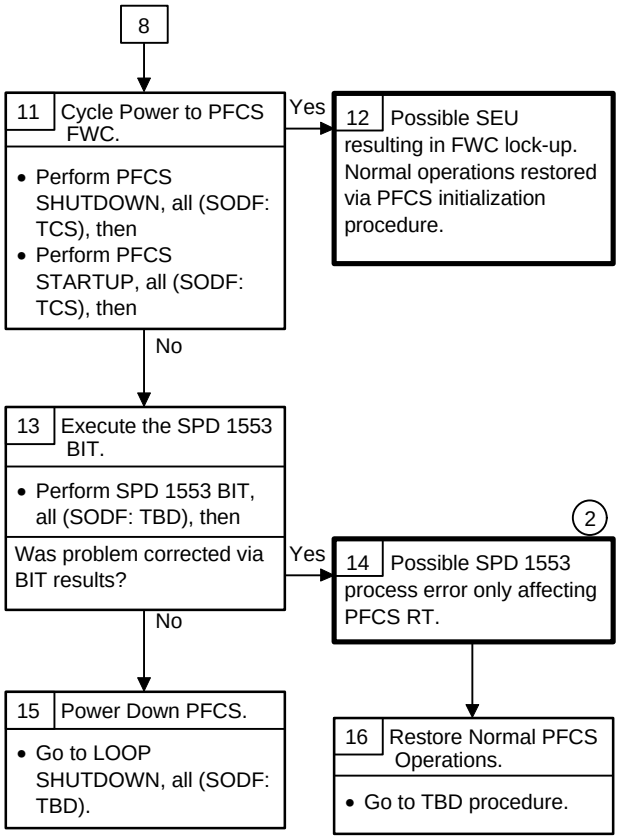
Yes → **9** Possible SEU of firmware controller.

10 Resume PFCS Operations.
- Check telemetry and command FCV back to radiator flow.

No → 11

(1)
PVCA issues this warning message either as a result of a loss of power to the PFCS, or due to 1553 Busy Bit Set, 1553 Status Word Message Error, PFCS BIT Failure, PFCS ORU Health Failure, PFCS Fault Status Data, or PFCS Time Synch Failure. Loss of power results in shutdown of the pump, while the other failures may allow the pump to continue to run, with the FCV in its last commanded position.

EEATC PFCS ORU FAILURE (Cont)



(2) 1553 FDIR processing a loss of comm for only the PFCS is a sign of good SPD 1553 processing. If SPD 1553 has a problem, multiple RTs would likely have LOC which causes a bus failure declaration. BIT is conducted as a final assurance before powering off the PFCS but may interrupt communication to other RTs.

EEATC PFCS OUTLET TEMP HIGH

Warning: EEATCS PFCS Max Outlet Temp Violation

Alarm Limit:

EEATCA(B) PFCS Outlet Temp1 ≥ 10° C (50° F) or EEATCA(B) PFCS Outlet Temp2 ≥ 10° C (50° F)

Nominal Config:

FCV Cntl - Ena

Max Out Temp FDIR - Inh

PVCU Mode - Not Fully Commanded

1 Check C&W Summary.

C&W Summary

Recent 'EEATCS Warm FCV Recal Condition' message?

Yes → 2

- Go to EEATC PFCS FCV OVERTEMP CONDITION, all (SODF: TCS).

No

3 Check Primary PVCU MDM Mode.

TCS Overview

Is PVCU Mode - Fully Commanded?

Yes → 4 All closed loop control and FDIR disabled. → 5

- √**MCC-H** concerning EEATCS Loop Manual Control.

No

6 Check FCV Control Status.

P6: TCS: EEATCS Overview: LoopA(B) PFCS Nominal Commands

Loop A(B) PFCS Nominal Commands

FCV Cntl - Ena?

No → 7

Loop A(B) PFCS Nominal Commands

- Continue to monitor PFCS Outlet Temp.
- √**MCC-H** concerning removal of FCV Control Inhibit or EEATCS Loop Manual Control.

Yes

(1)

8 Check FCV Calculated Setpoint.

Loop A(B) PFCS Nominal Commands

Is FCV Calc Setpt > 80°?

No → 9 Possible FCV Control algorithm problem. → 15

Yes

10 Verify FCV at or Moving Toward the Calculated Setpoint.

Loop A(B) PFCS Nominal Commands

Is FCV Integ Posn at or incrementing toward the FCV Calc Setpt?

Yes → 11 Possible hot environment. → 12

Loop A(B) PFCS Nominal Commands

- Continue to monitor PFCS Outlet Temp.
- √**MCC-H** concerning data trending and possible attitude change.

No

13 Check for Additional Advisory Message.

PCS: Advisory Log

Advisory Log

Recent 'EEATCS Outlet Temp Inter Sensor Error'?

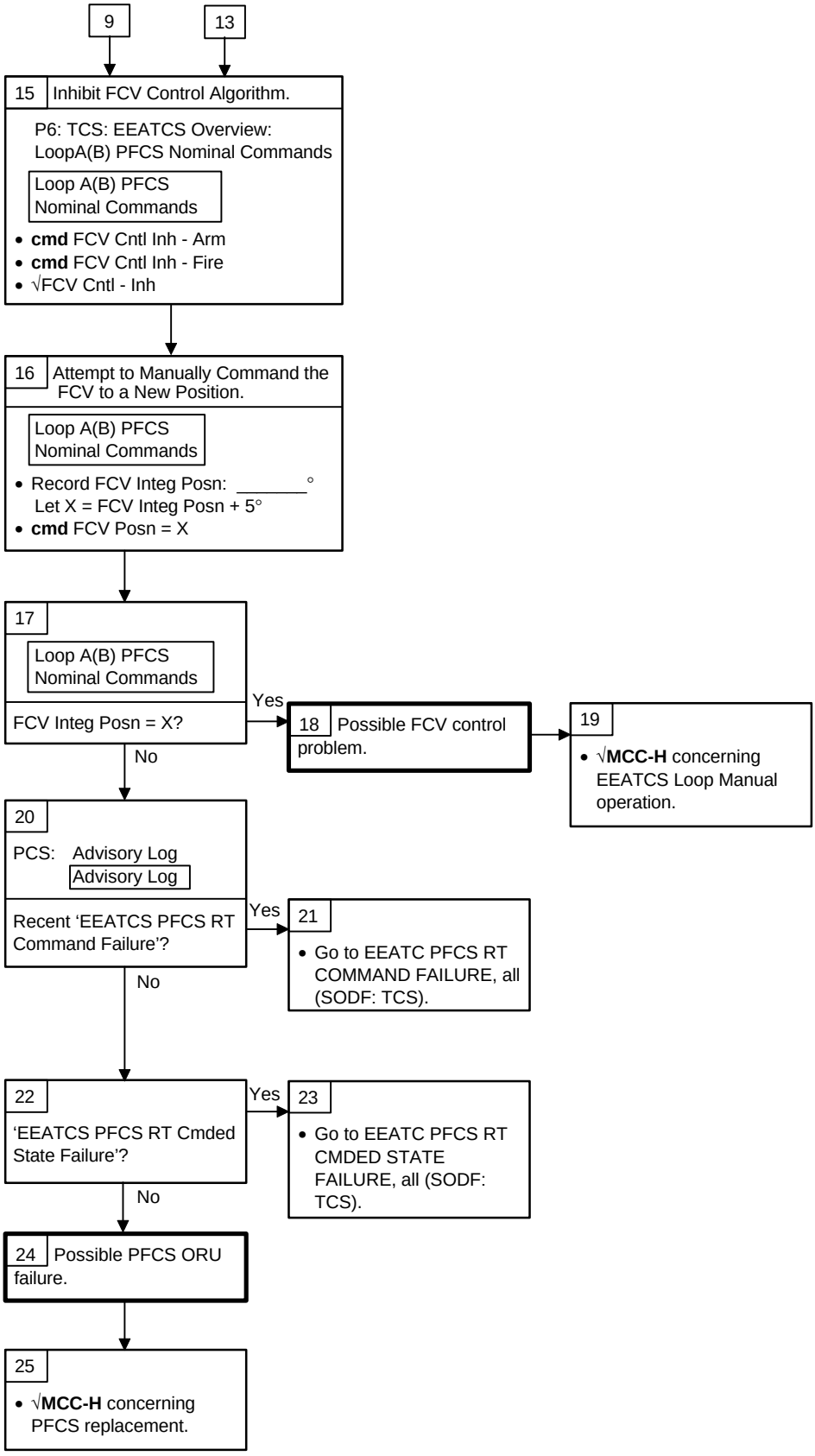
Yes → 14

- Go to EEATC PFCS OUTLET TEMP INTER SENSOR ERROR, all (SODF: TCS).

No → 15

(1) The FCV Full Radiator Flow value is 90 degrees. If the FCV Calculated setpoint is 80 degrees or higher, the the FCV Control algorithm is attempting to drive the FCV to a cooler position. This indicates the control algorithm is working properly.

EEATC PFCS OUTLET TEMP HIGH (Cont)



EEATC PFCS OUT TEMP LO

WARNING

WARNING: EEATCS PFCS Min Outlet Temp Violation

Message triggered when EEATC PFCS Out Fltrd Lwr Temp = 1.11°C

or

EEATC PFCS Out Line Fltrd Temp = 1.11°C

Nominal Config:
EEATCA,B PFCS PumpA(B) Conv Speed = 14,250 ± 500 rpm
EEATCA,B PFCS Out Fltrd Lwr Temp = 3.33°C ± 1.68
EEATCA,B PFCS Out Line Fltrd Temp = 3.33°C ± 1.68
EEATCA,B PFCS Integ Counter - Incrementing
PVCU 2B(4B) Mode ≠ Fully Commanded
EEATCA,B PFCS FCV Cntl - Ena
EEATCA,B PFCS Min Out Temp FDIR - Ena
EEATCA,B PFCS Min Out Line Temp FDIR - Ena

1 C&W Summary
'EEATCS FDIR Failure-Pumps/PFCS Not Off' msg?
Yes → 2
- Go to 4A EEATCS FDIR FAILURE-PUMPS/PFCS NOT OFF, all (SODF: TCS).

No →

3 Determine PFCS State.
P6: TCS: EETCS Overview
EETCA(B) PFCS Integ Counter Incrementing?
No → 4 PFCS power has been shutdown by FDIR. (1)
→ 16

Yes →

5 Verify FDIR Success.
- EEATCA(B) PFCS Pump A,B Conv Spd = 0 ± TBD?

No → 6
P6: TCS: Loop A(B) PFCS: Loop A(B) PFCS FDIR Commands
Min Out Temp FDIR - Inh?
Yes → 7
- √**MCC-H** concerning removal of inhibit.

No →

8 P6:TCS:EETCS Overview
PVCU Mode - Fully Commanded?
Yes → 9 All closed loop control and some FDIR functions disabled. (1)
→ 11
- √**MCC-H** concerning EEATCS Loop Manual Control.

No →

10 EEATC Min Out Temp FDIR has failed. This is a dual failure case
→ 12
- Go to 4A EEATCS FDIR FAILURE-PUMPS/PFCS NOT OFF, all (SODF: TCS).

Yes →

13 C&W Summary
'EEATCS FDIR Failure-Heaters not off' msg?
Yes → 14
- Perform EEATCS FDIR FAILURE-HEATERS NOT OFF, all (SODF: TCS)

→ 24

No →

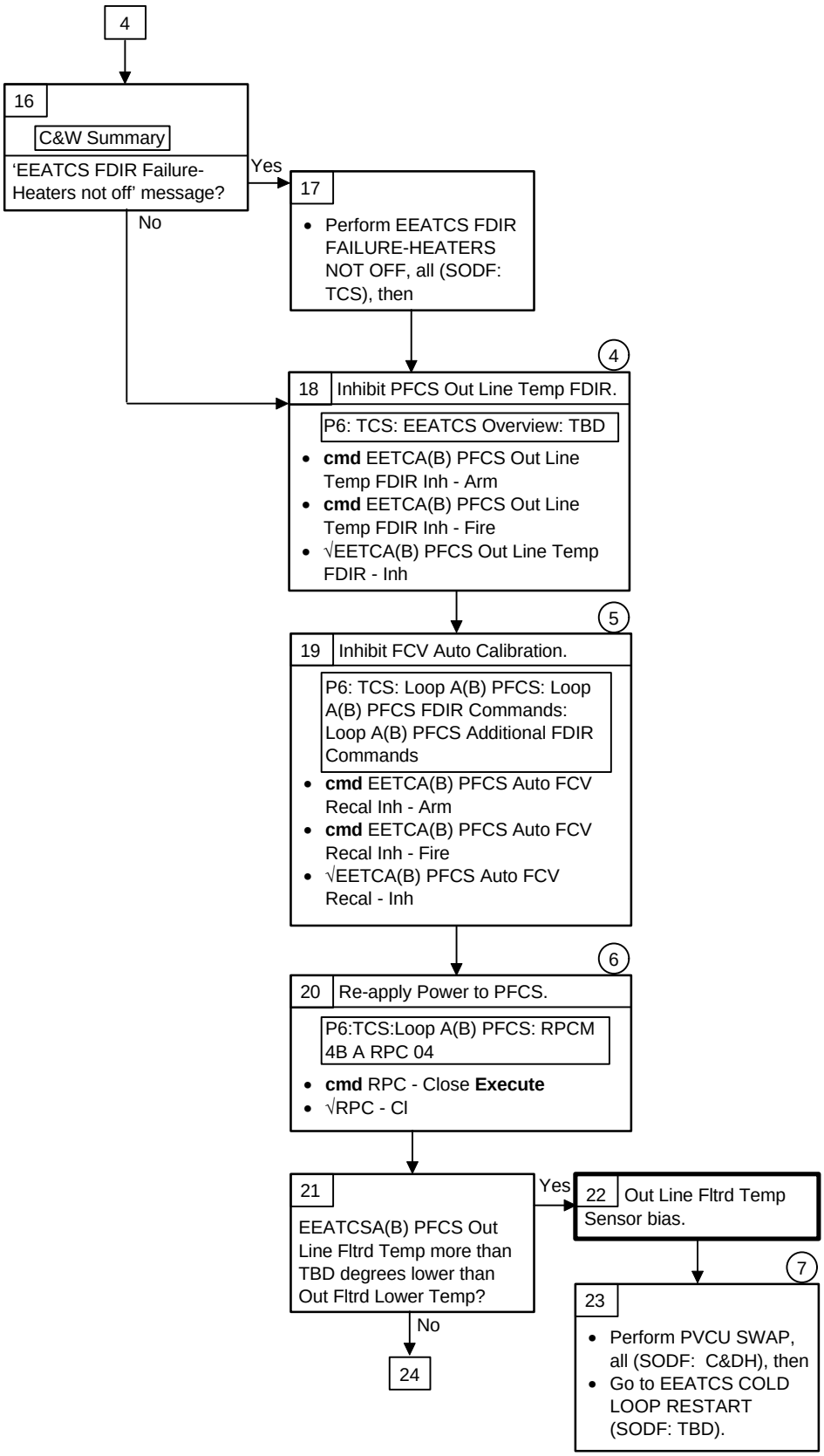
15 FDIR successful. (2)
→ 24

(1) Only the EEATCA(B) PFCS Integration counter, the EEATCA(B) PFCS RPC Position (drives the pump icons), and the EEATCA(B) PFCS Out Line Fltrd Temp telemetry are valid. All other PFCS parameters for Loop A(B) are invalid. Also note that the FDIR will command the EEATCA(B) In-line heaters off.

(2) An 'EEATCS PFCS Min Outlet Temp Violation Trip' message will be entered into the Advisory Log when FDIR actions are verified complete. Note that this FDIR routine will also command the EEATCA(B) In-line heaters off.

(3) When the PVCU is in fully commanded mode, the EETC loop has no automatic temperature control capability. Most FDIR routines are also not active. CLC and FDIR telemetry will <u>not</u> reflect the fact that these capabilities are disabled.

EEATC PFCS OUT TEMP LO (Cont)



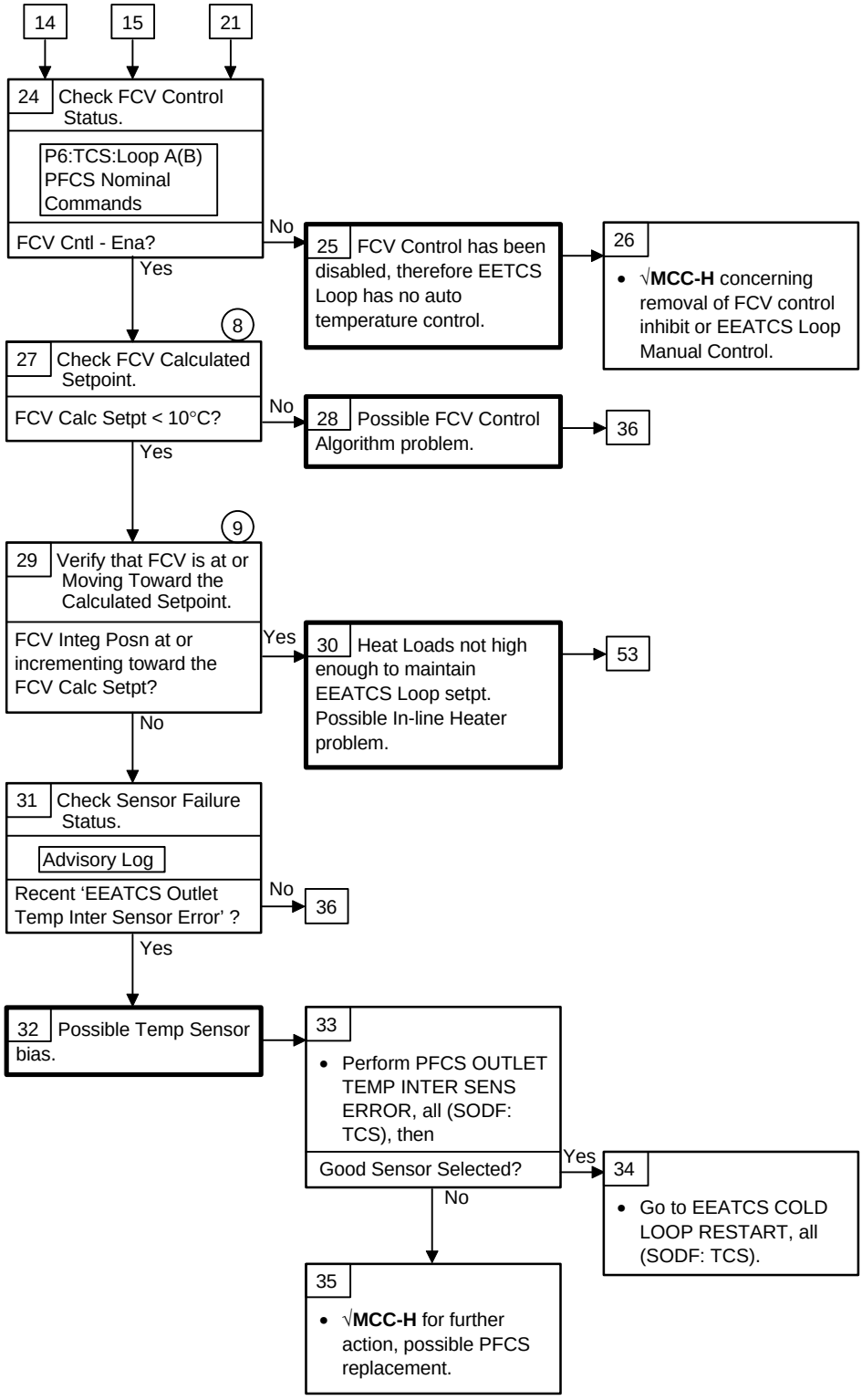
(4) This FDIR routing must be inhibited in order to power up the PFCS for troubleshooting.

(5) The FCV auto calibration must be inhibited to prevent the PFCS from commanding FCV motion during the start-up sequence. FCV position at the time of the failure is a key parameter for troubleshooting.

(6) All PFCS telemetry will be valid now that the PFCS power has been restored.

(7) Each PVCU utilizes a different EEATCS Out Line Fltrd Temp sensor. Therefore, a PVCU swap will essentially swap EEATCS Out Line Fltrd Temp sensors.

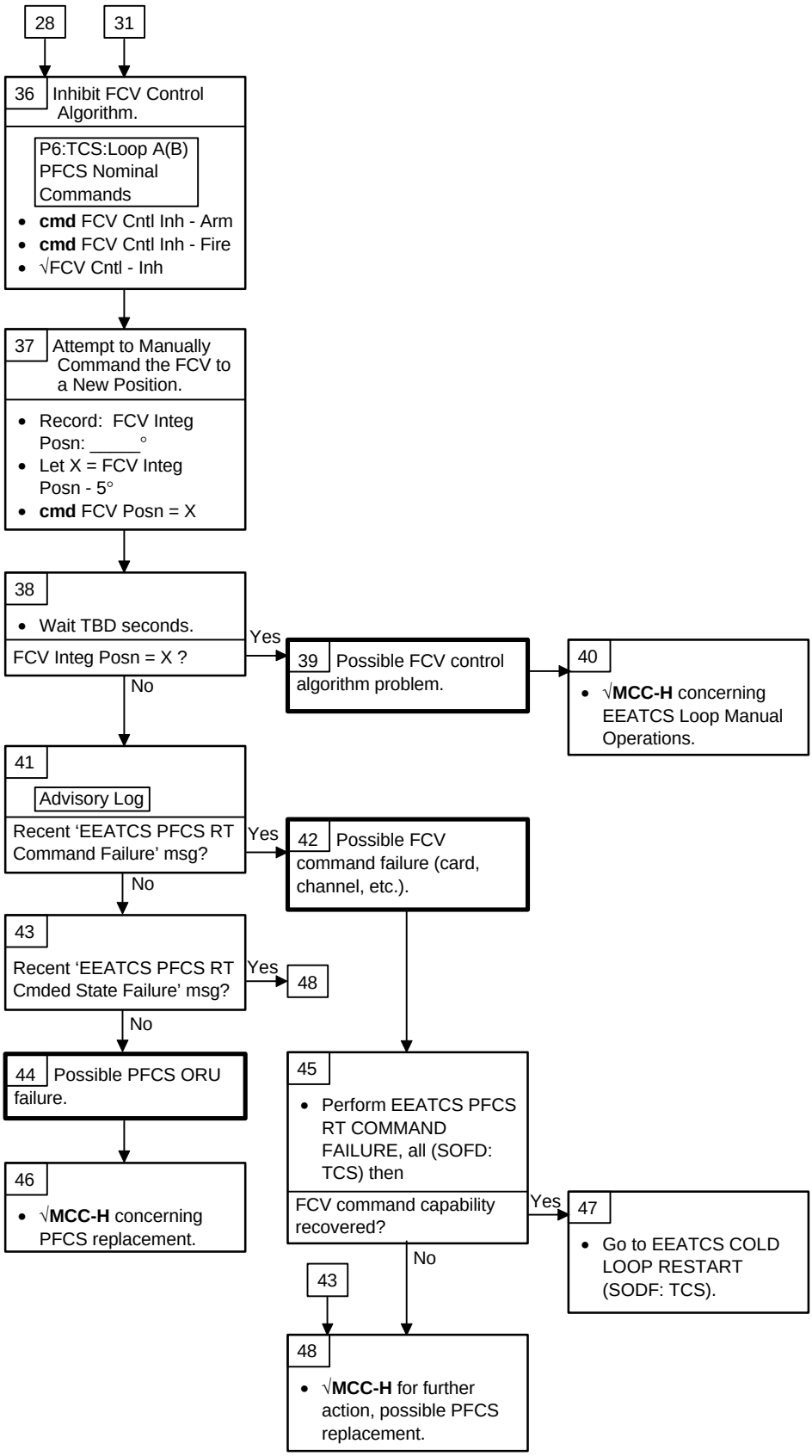
EEATC PFCS OUT TEMP LO (Cont)



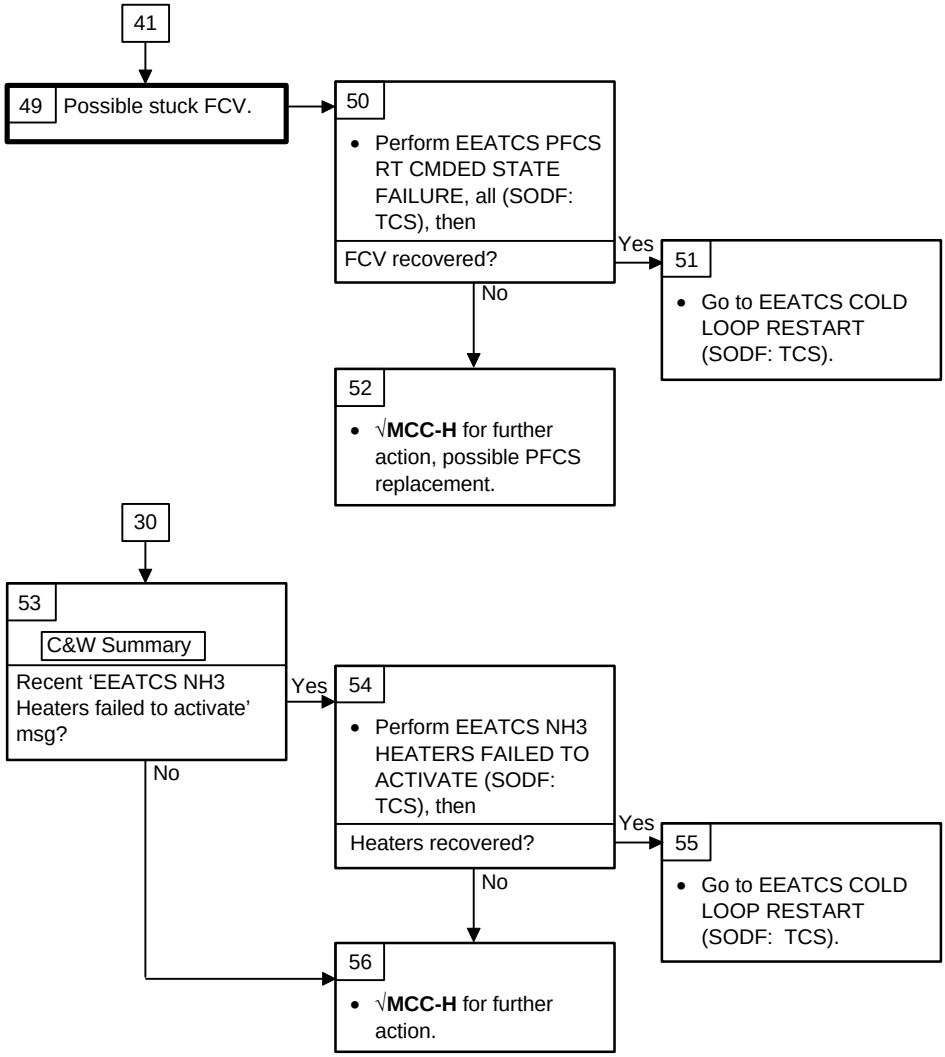
(8) The FCV algorithm should be calculating an FCV position of fully bypassed (since the ammonia is cold). Fully bypassed is 0°.

(9) The FCV should be in, or incrementing toward the commanded position. Note that the FCV cannot be positioned at less than 10° to insure some ammonia flow through the radiators to prevent manifold freezing.

EEATC PFCS OUT TEMP LO (Cont)



EEATC PFCS OUT TEMP LO (Cont)



EEATC PUMP FAILURE

Caution:
EEATC A(B)
Pump A(B) Fail

Alarm Limit:
EEATCA(B) Pump A(B) Conv Spd < 12000 RPM and Flow Rate < TBD kg/hr (0.8 psid)

Nominal Config:

EEATCA(B) Pump A - On, Pump B - Off

Pump FDIR - Ena

EEATCA(B) Pump A(B) Conv Spd = 14250 +/- 975 RPM

EEATC A(B) Integ

(1)

1 Warning message 'EEATC Pump Switchover Failed'?
- Yes → 11
- No

2 P6: TCS: EEATCS Overview: LoopA(B) PFCS FDIR Commands
[LoopA (B) PFCS FDIR Commands]
Pump FDIR = Inh?
- Yes → 3 EEATC A(B) Pump A(B) degraded/failed. √**MCC-H** for further action.
- No

4 Determine Redundant Pump Status.
EEATC A(B) Pump B(A) Conv Spd = 14250 ± 975 RPM?
- Yes → 5 EEATC A(B) Pump A(B) degraded/failed. FDIR switched to Pump B(A).
  - 6 Inhibit Pump Fail Rcvy Algorithm.
    [Loop A(B) PFCS FDIR Commands]
    - **cmd** Pump FDIR Inh - Arm
    - **cmd** Pump FDIR Inh - Fire
    - √Pump FDIR - Inh
- No

7 P6: TCS: EEATCS Overview
[EEATCS Overview]
EEATC A(B) Integ Flow Rate < 765 kg/hr?
- Yes → 8 EEATC A(B) Pump A(B) degraded/failed. FDIR switched to Pump B(A), but this pump is also degraded. √**MCC-H** for possible PFCS replacement.
- No

9 EEATC A(B) Pump A(B) degraded/failed. FDIR switched to Pump B(A), but speed sensor may be shifted. √**MCC-H** for possible PFCS replacement.
- 10 Inhibit Pump Fail Rcvy Algorithm.
  P6: TCS: EEATCS Overview: LoopA(B) PFCS FDIR Commands
  [Loop A(B) PFCS FDIR Commands]
  - **cmd** Pump FDIR Inh - Arm
  - **cmd** Pump FDIR Inh - Fire
  - √Pump FDIR - Inh

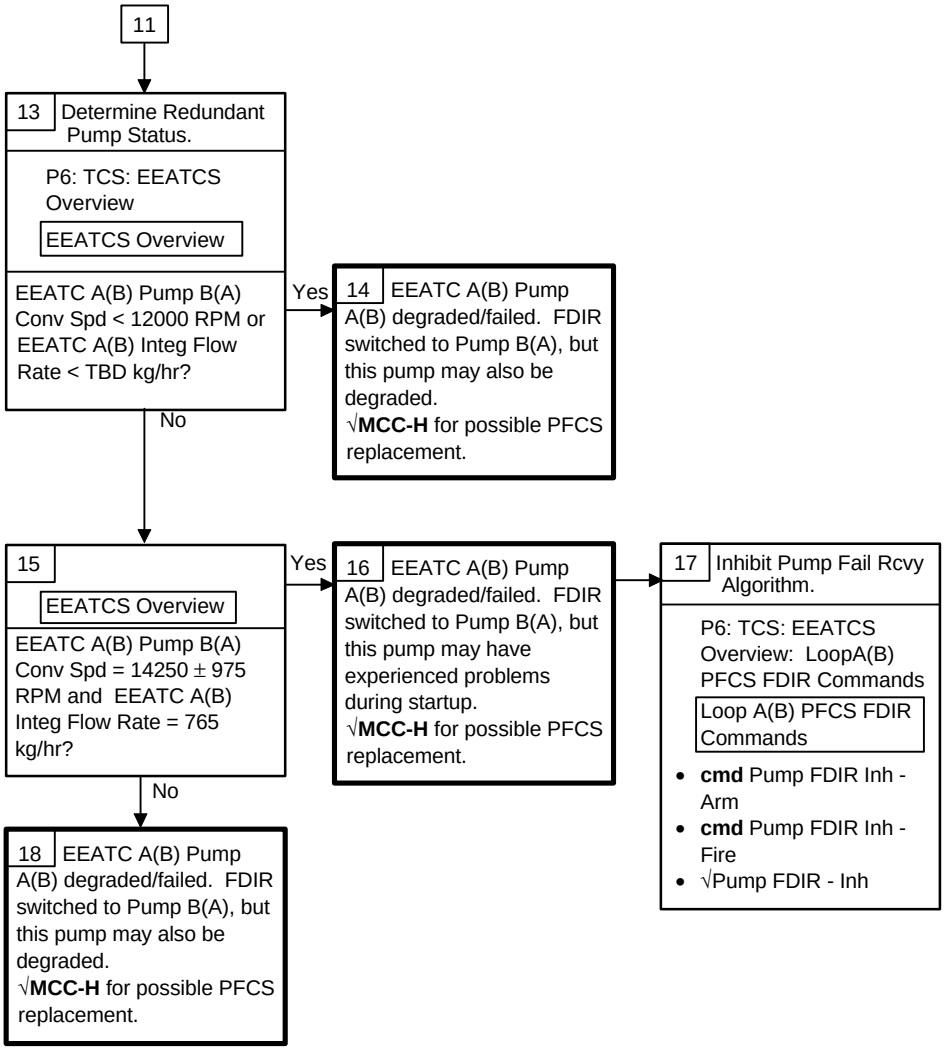
1

11 Check Command State Failure.
PCS: Advisory Log
[Advisory Log]
Recent 'EEATCS PFCS RT Cmded State Failure'?
- Yes → 12 EEATC A(B) Pump A(B) degraded/failed. FDIR unable to switch to redundant pump. → 19
- No → 13

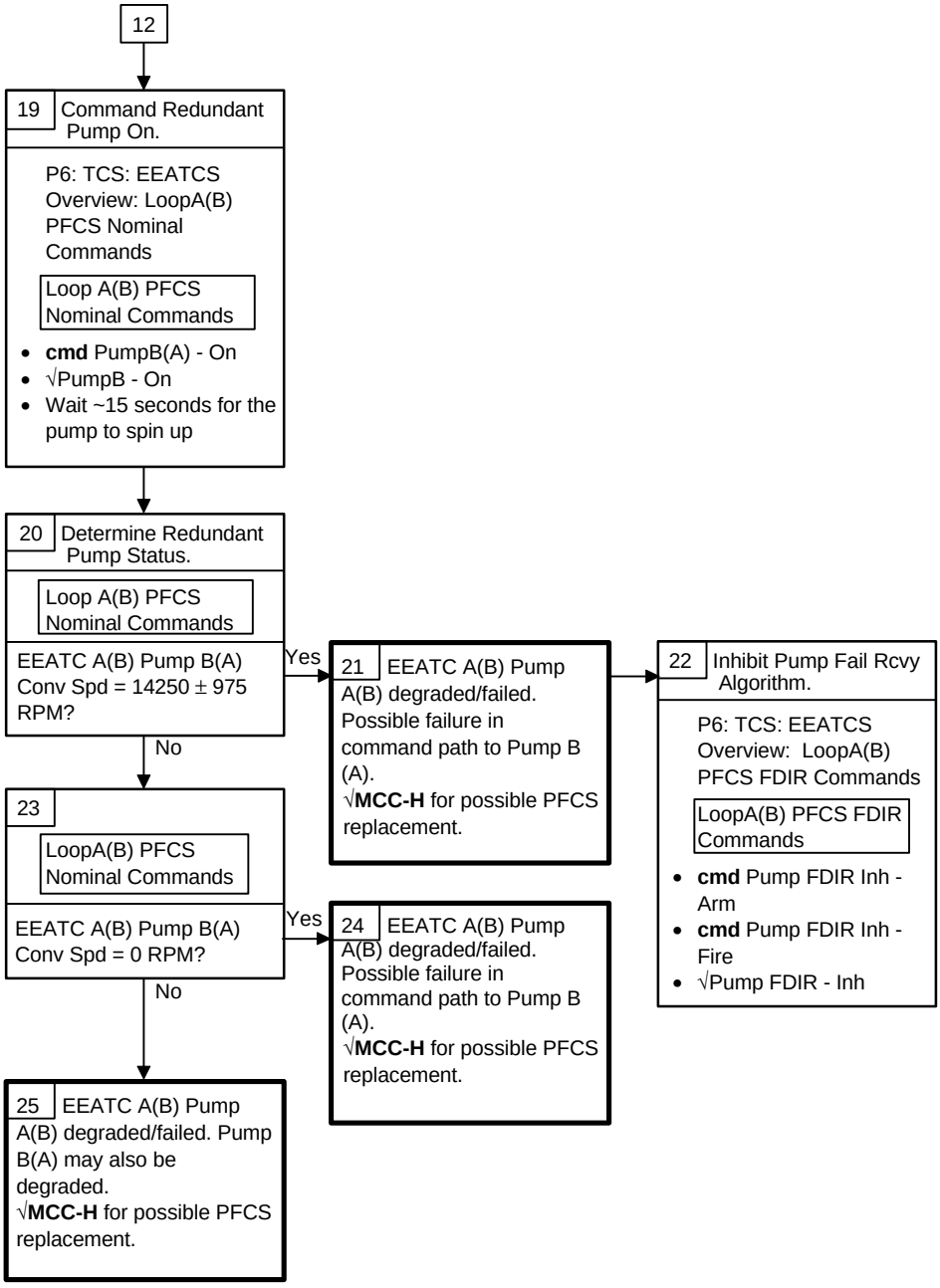
(1) FDIR attempts to switch to the redundant pump if it detects both a pump speed of < 12000 RPM and a flow rate of < TBD kg/hr for at least 16 seconds. The switch is declared failed if either of these parameters are still below the minimum after the attempted switch.

(2) Pump Fail Rcvy will only be INH if prior problems had been noted with the redundant pump. **MCC-H** should be consulted before attempting to use this pump.

EEATC PUMP FAILURE (Cont)



EEATC PUMP FAILURE (Cont)



EEATC FDIR FAILURE - PUMPS/PFCS NOT OFF

Warning: EEATCS FDIR Failure-Pumps/PFCS Not Off

Msg triggered when: EEATCS PFCS Min Outlet Temp Violation FDIR fails to automatically shut down pumps/PFCS.

Nominal Config:
EEATCA,B PFCS PumpA(B) Conv Speed = 14,250 ± 500 rpm
EEATCA,B PFCS Out Fltrd Lwr Temp = 3.33 °C ± 1.68
EEATCA,B PFCS Out Line Fltrd Temp = 3.33 °C ± 1.68
EEATCA,B PFCS Integ Counter - Incrementing
PVCU 2B(4B) Mode ≠ Fully Commanded
EEATCA,B PFCS FCV Cntl - Ena
EEATCA,B PFCS Min Out Temp FDIR - Ena
EEATCA,B PFCS Min Out Line Temp FDIR - Ena

1
P6: TCS: Loop A(B) PFCS Nominal Commands
- **cmd** EEATCA(B) PumpA - Off
- **cmd** EEATCA(B) PumpB - Off

2
P6: EEATCS Overview
EEATCA(B) PFCS Pump A,B Conv Spd = 0 ± TBD?
No → 3 PFCS command problem. (1)
Yes

3 PFCS command problem. (1)

4
P6: TCS: Loop A(B) Nominal Commands: RPCM 4B A RPC 04
- **cmd** RPC - Open **Execute**
- √RPC Position - Open

7
- Go to EEATC PFCS OUT TEMP LO block 16 (SODF: TCS).

5
P6: TCS: Loop A(B) PFCS:Loop A(B) PFCS FDIR Commands
Min Out Temp FDIR - Inh?
Yes → 6
No

6
- √**MCC-H** concerning removal of inhibit.

8
P6: EEATCS Overview
PVCU Mode - Fully Commanded?
Yes → 9 All Closed Loop Control and some FDIR functions disabled. (2)
No

9 All Closed Loop Control and some FDIR functions disabled. (2)

11
- √**MCC-H** concerning EEATCS Loop Manual Control.

10 EEATC Min Outlet Temp Violation FDIR failure.

12
- √**MCC-H** for further action.

(1) Troubleshooting of this problem will occur in the EEATCS PFCS Min Outlet Temp Violation Malfunction Procedure.

(2) When the PVCU is in fully commanded mode, the EEATC loop has no automatic temperature control capability. Most FDIR routines are also not active. CLC and FDIR telemetry will not reflect the fact that these capabilities are disabled.

NODE 1 SHELL HEATER FAILURE

Advisory:
NODE1 Htr[X] B(A) Failed

User Notification

PCS NODE1: TCS
NODE1: TCS

sel NODE1 Htr[X]B(A)

Health Stat - Faild

PCS NODE1: TCS
NODE1: TCS

Attention symbol appears next to NODE1 Htr[X]B(A)

Nominal Stage Config:
nav NODE 1: TCS
NODE1: TCS
NODE1 Htr [X]B Availbty - Ena Opr

NODE1 Htr [X]A Availbty - Ena BU

RPCM N1RS2A
RPC 1, 2, 3, 4, 12, 13, 14, 15, 16 Close Cmd - Enable

RPCM N1RS1A
RPC 1, 2, 3, 4, 12, 13, 14, 15, 16 Close Cmd - Inhibit

Nominal Assy Config
During Pre-Ingress Warmup, Ingress and Post-Egress Dryout, the heater availability will be variable (limited by power and zone temperature priorities). This procedure accounts for these periods as well as the nominal stage config.

1 Check Heater Failure Flags.

PCS NODE 1: TCS
NODE 1: TCS
- sel NODE1 Htr[X]B(A)
- Determine condition via failure flags:

Availbty - Inh and Cmd Stat - On	82
Hi Lim Violatn - True	6
Low Lim Violatn - True	45
No Val Temp Snsrs - True	2
Temp Snsrs Disagree - True	79
Temp Snsr Stat1(2) - Faild	5
RPC Position - Op and Cmd Stat - On	59
RPC Position - Cl and Cmd Stat - Off	20
RPC Position - Cl and Availbty - Inh	12
RPC - Trip?	55

2 All B(A) Temp Sensors failed?
No → 87
Yes

3 Possible loss of MDM Card N1-2 A03 (N1-1 A03).

4
- Perform MDM IO Card Failure (ISS MAL: C&DH).
- √**MCC-H** for heater reconfiguration.

1

5 Temp sensor failure. No action required.

1

6 Temp(Temp1 or Temp 2) > Temp Snsr(Temp Snsr 1 or Temp Snsr 2) Failure Upper Limit?
No → 7 Transient failure. → 8
- Continue nominal operations.

Yes

9 RPC Position - Op?
Yes → 10 Possible transient hot thermal environment.
No → 22

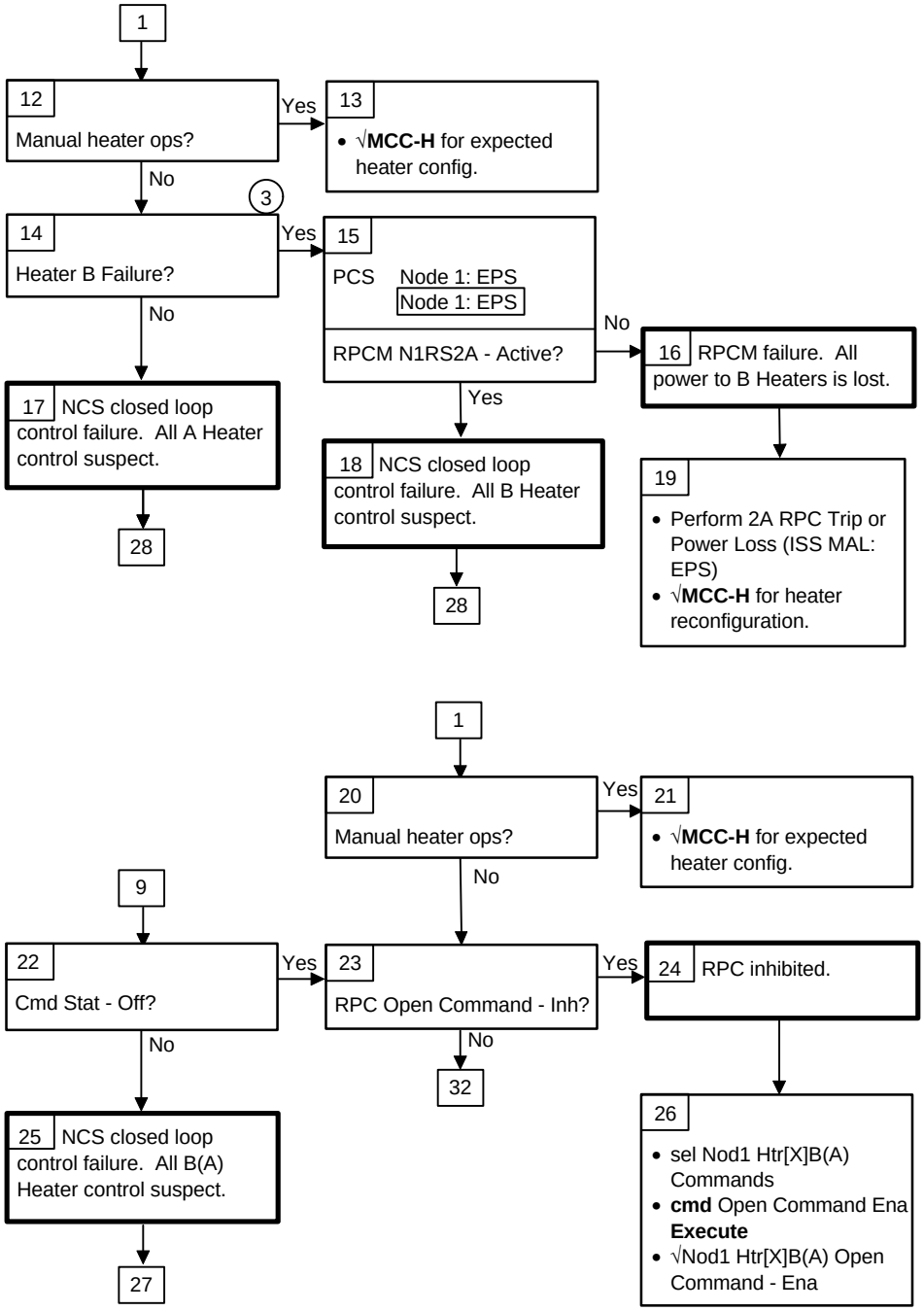
2

11
- √**MCC-H** for further action.

(1) NCS software will no longer consider this temperature sensor valid. Software will automatically deselect sensor and use the redundant sensor for closed loop control.

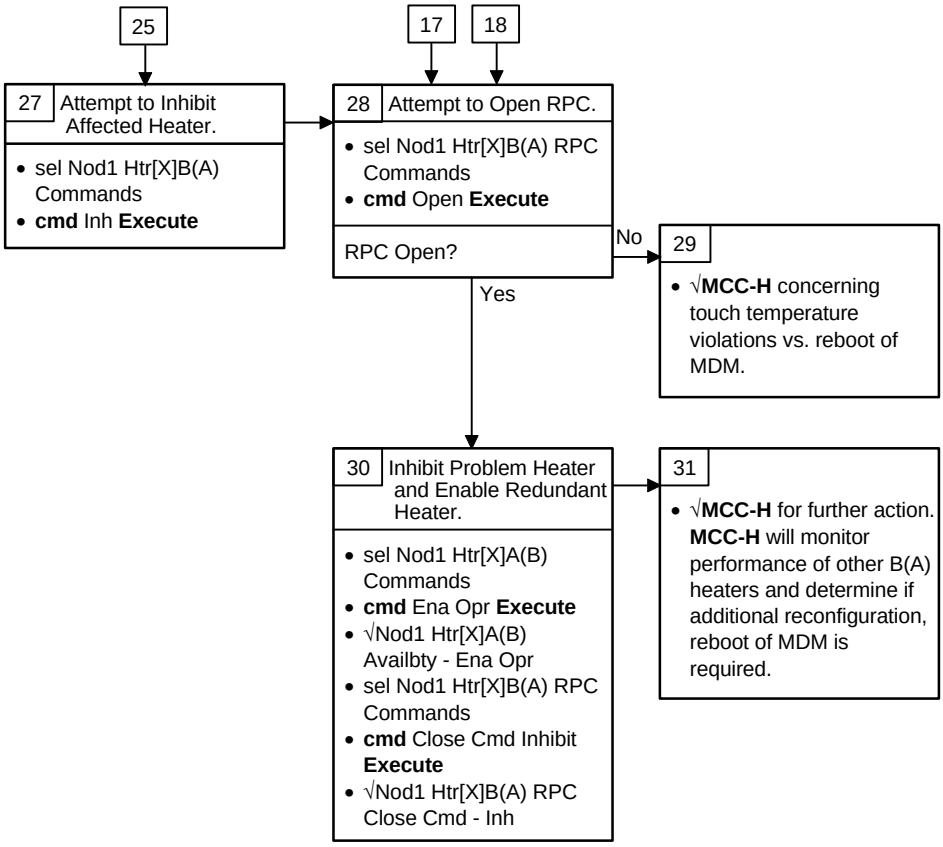
(2) Failure Upper Limit band may be set too small. **MCC-H** may uplink a change to Failure Upper Limit.

NODE 1 SHELL HEATER FAILURE (Cont)

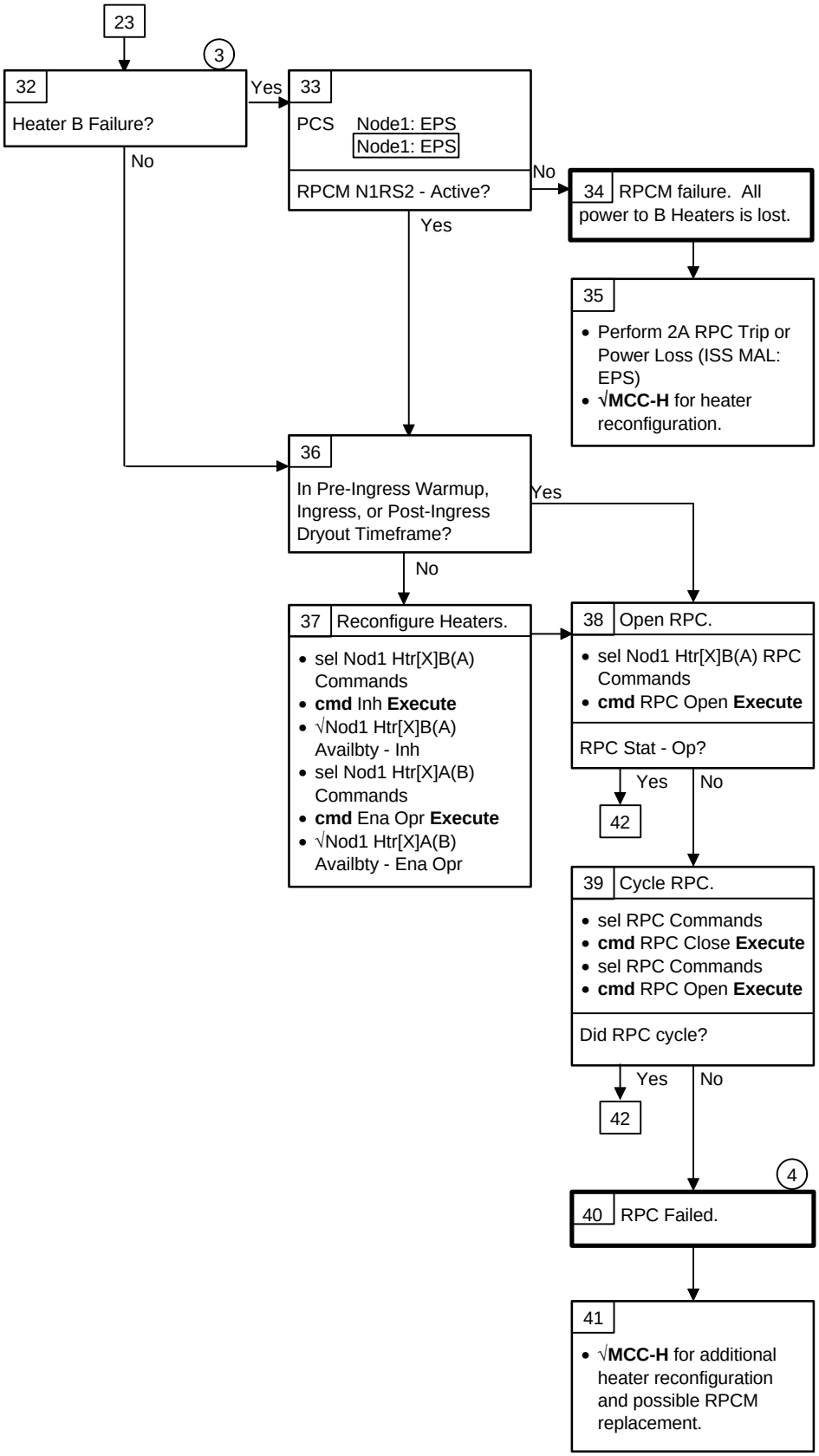


(3) The A Heaters are connected to the same RPCM as MDM N1-1. The MDM Failure malfunction will be worked in that case. The B Heaters are not connected to the same RPCM as MDM N1-2; therefore, it is possible that the heater configuration problem could be detected before the RPCM failure.

NODE 1 SHELL HEATER FAILURE (Cont)



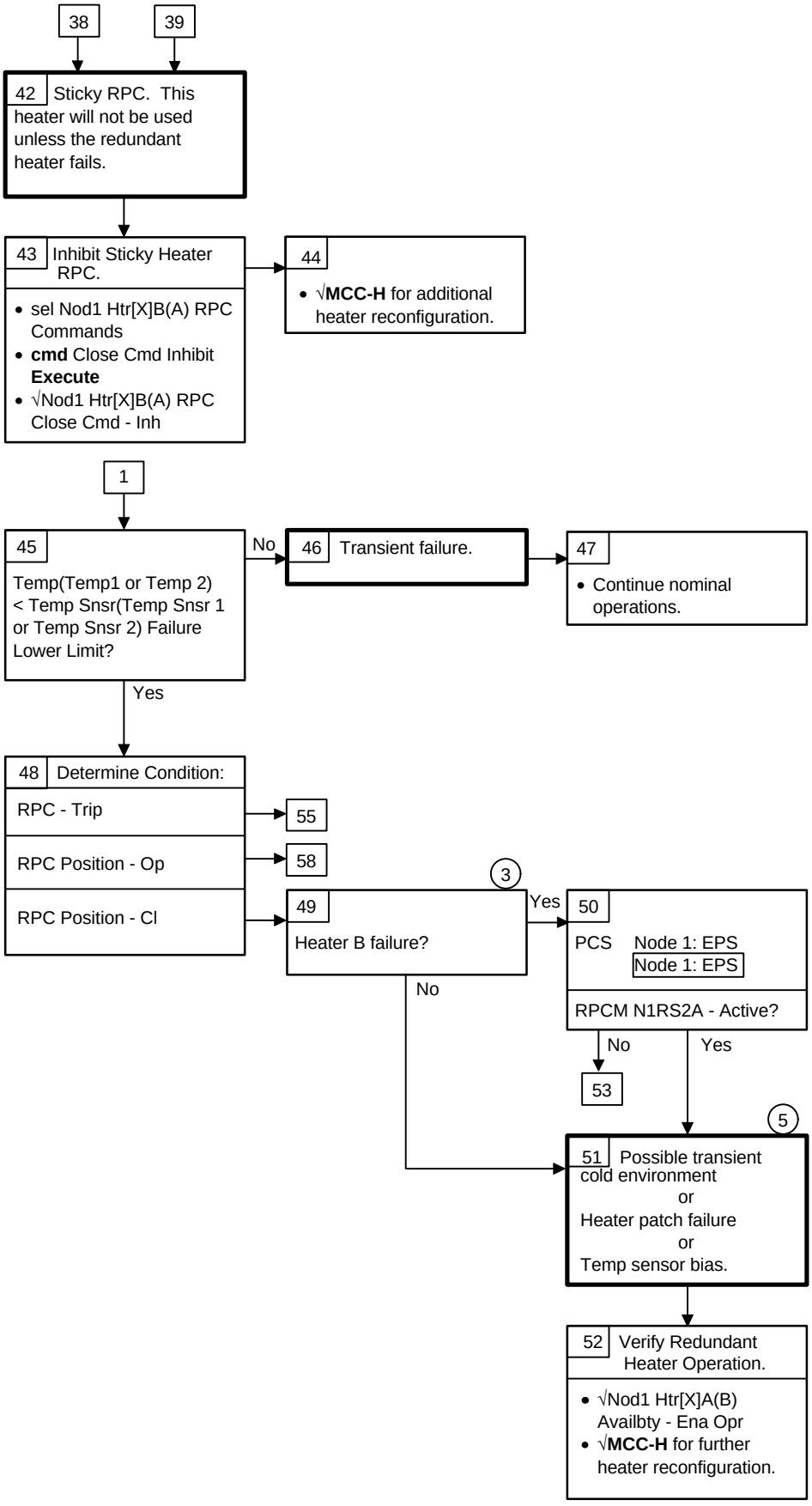
NODE 1 SHELL HEATER FAILURE (Cont)



(3)
The A Heaters are connected to the same RPCM as MDM N1-1. The MDM Failure malfunction will be worked in that case. The B Heaters are not connected to the same RPCM as MDM N1-2; therefore, it is possible that the heater configuration problem could be detected before the RPCM failure.

(4)
MCC-H will evaluate the possibility of touch temperature violations and the consequences of leaving the heater on.

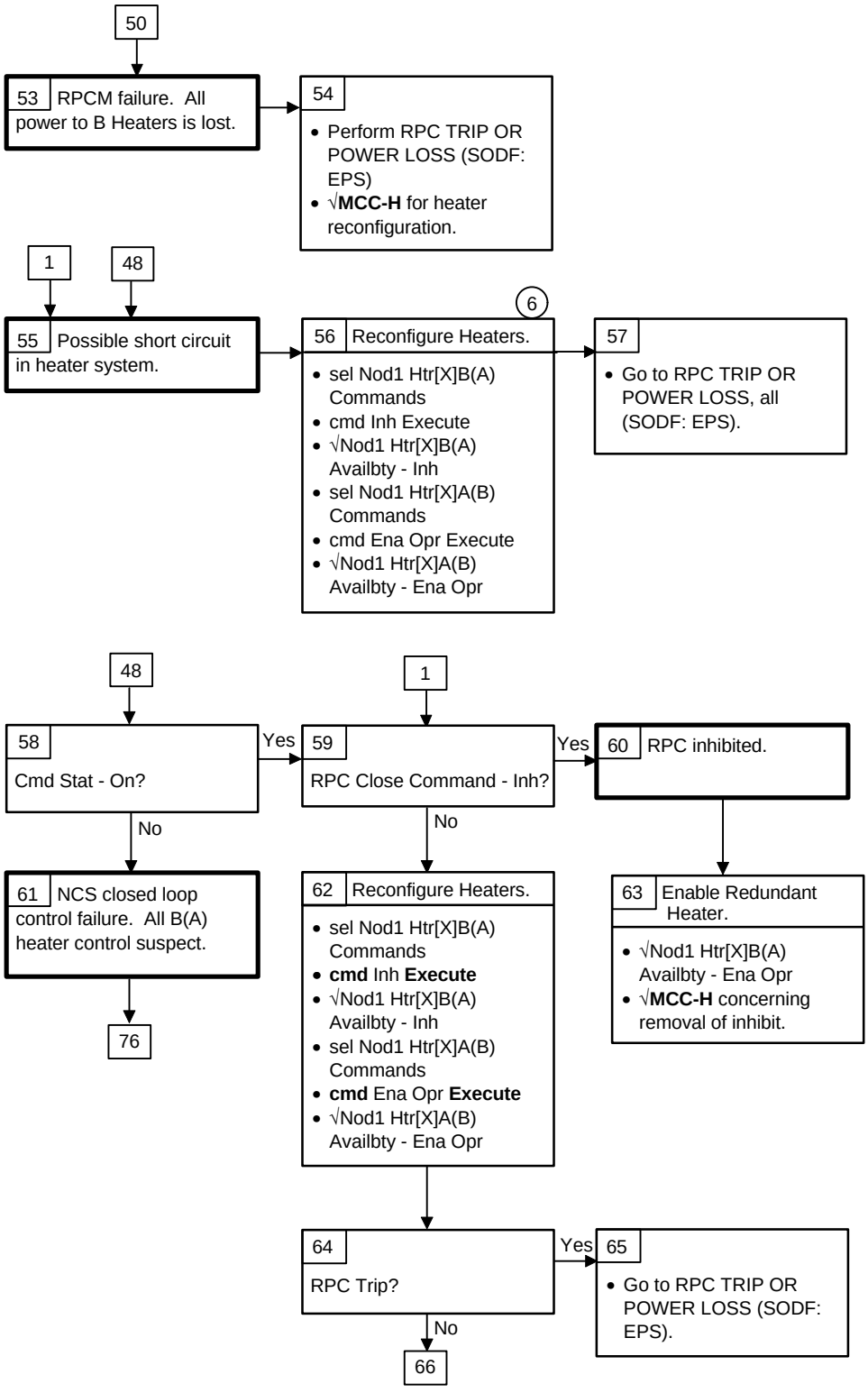
NODE 1 SHELL HEATER FAILURE (Cont)



(3)
The A Heaters are connected to the same RPCM as MDM N1-1. The MDM failure malfunction will be worked in that case. The B Heaters are not connected to the same RPCM as MDM N1-2; therefore, it is possible that the heater configuration problem could be detected before the RPCM failure.

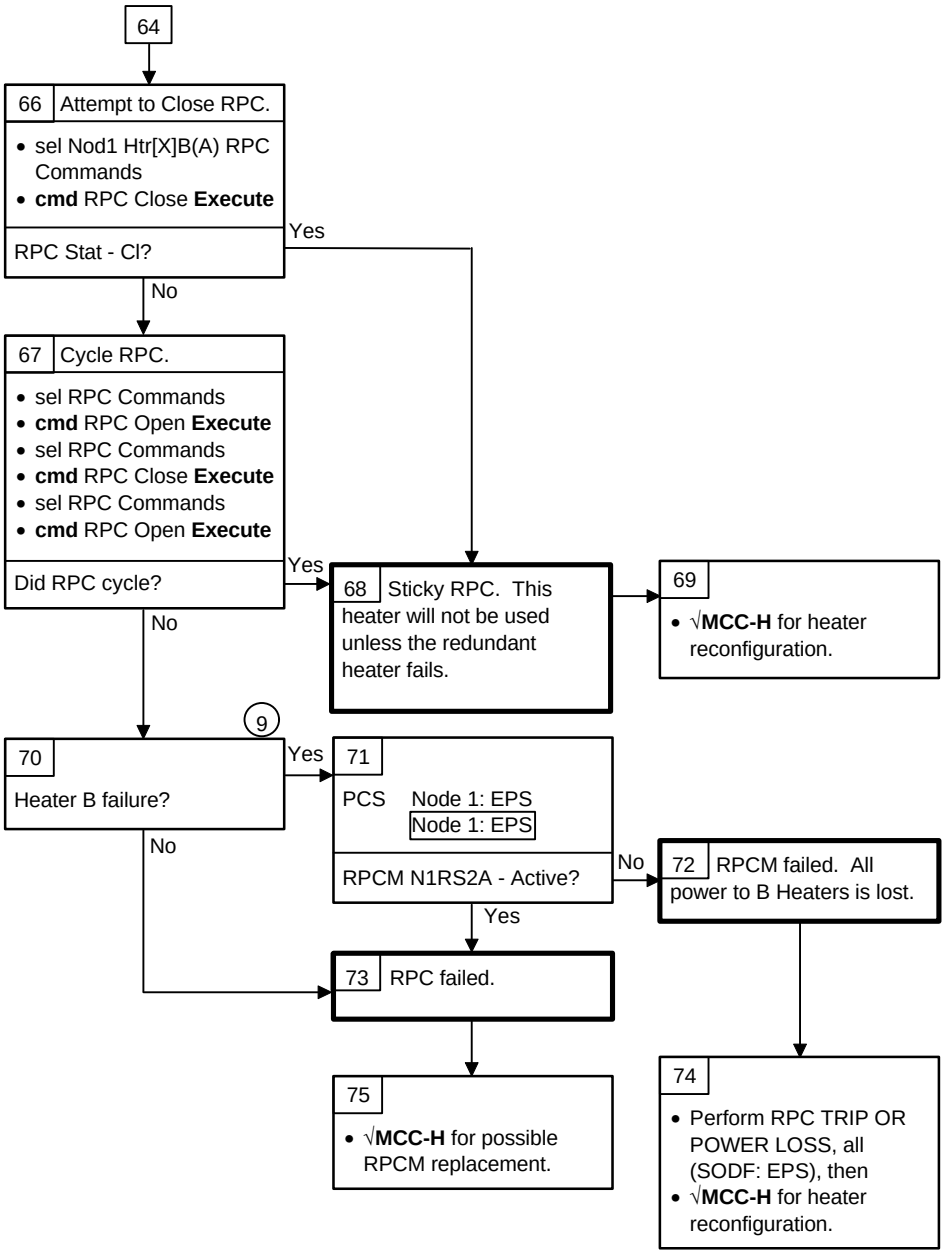
(5)
A transient cold environment could require both B and A Heaters to keep temperatures within limits. A heater pad degonding failure or open circuit failure could also be the culprit in this case.

NODE 1 SHELL HEATER FAILURE (Cont)



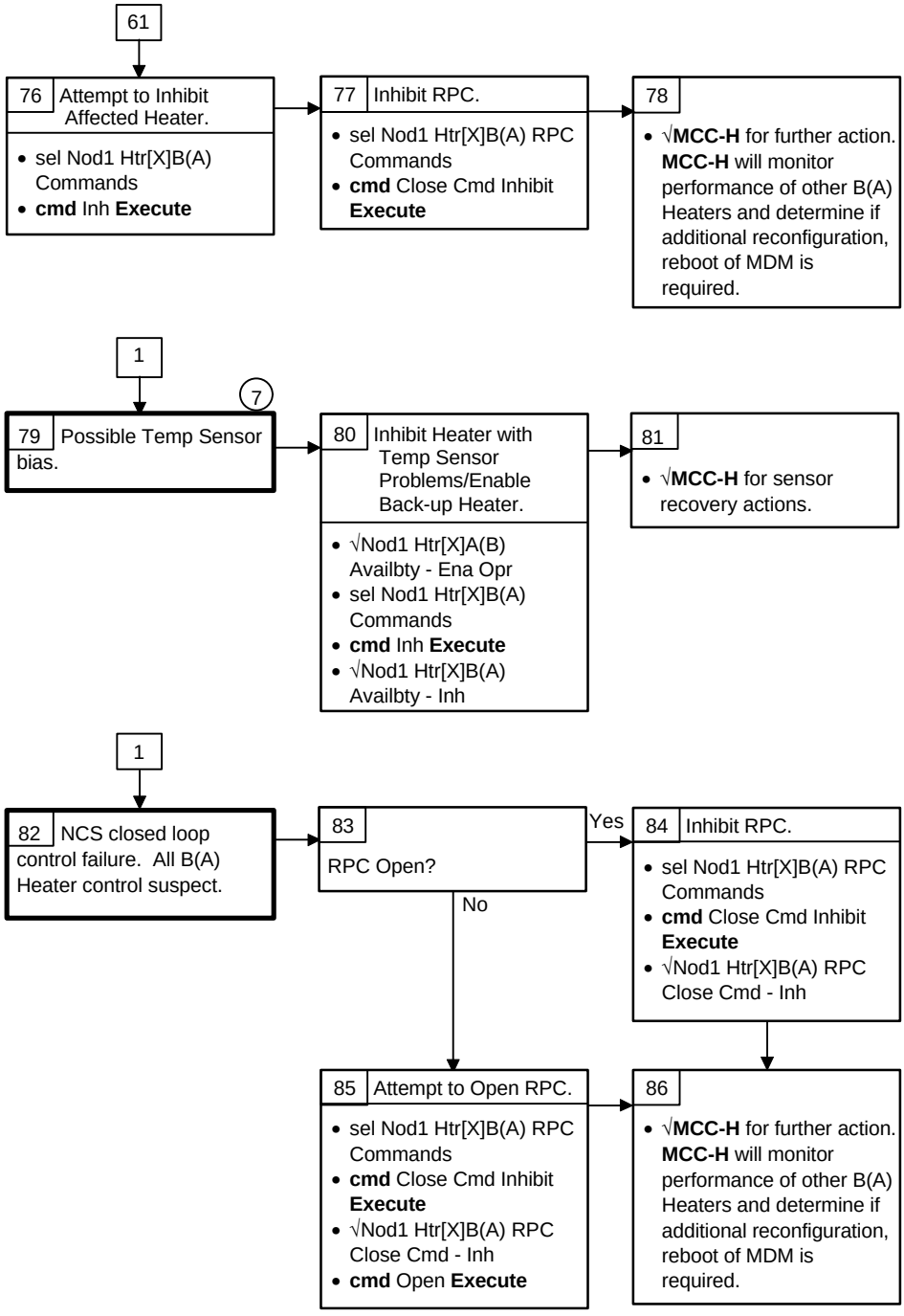
(6) Since the RPC has tripped once, it will not be used again unless necessary.

NODE 1 SHELL HEATER FAILURE (Cont)



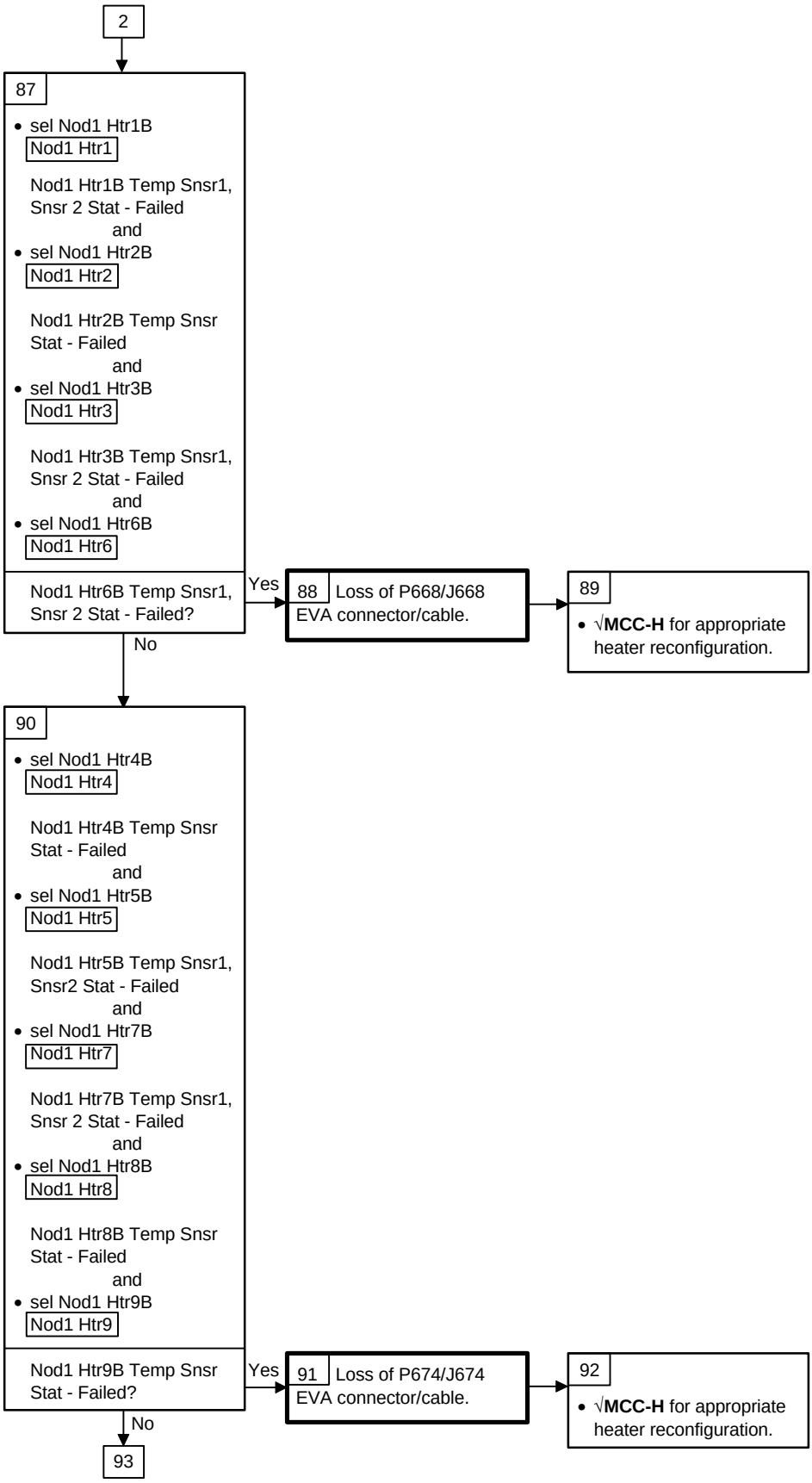
(3) The A Heaters are connected to the same RPCM as MDM N1-1. The MDM failure malfunction will be worked in that case. The B Heaters are not connected to the same RPCM as MDM N1-2; therefore, it is possible that the heater configuration problem could be detected before the RPCM failure.

NODE 1 SHELL HEATER FAILURE (Cont)

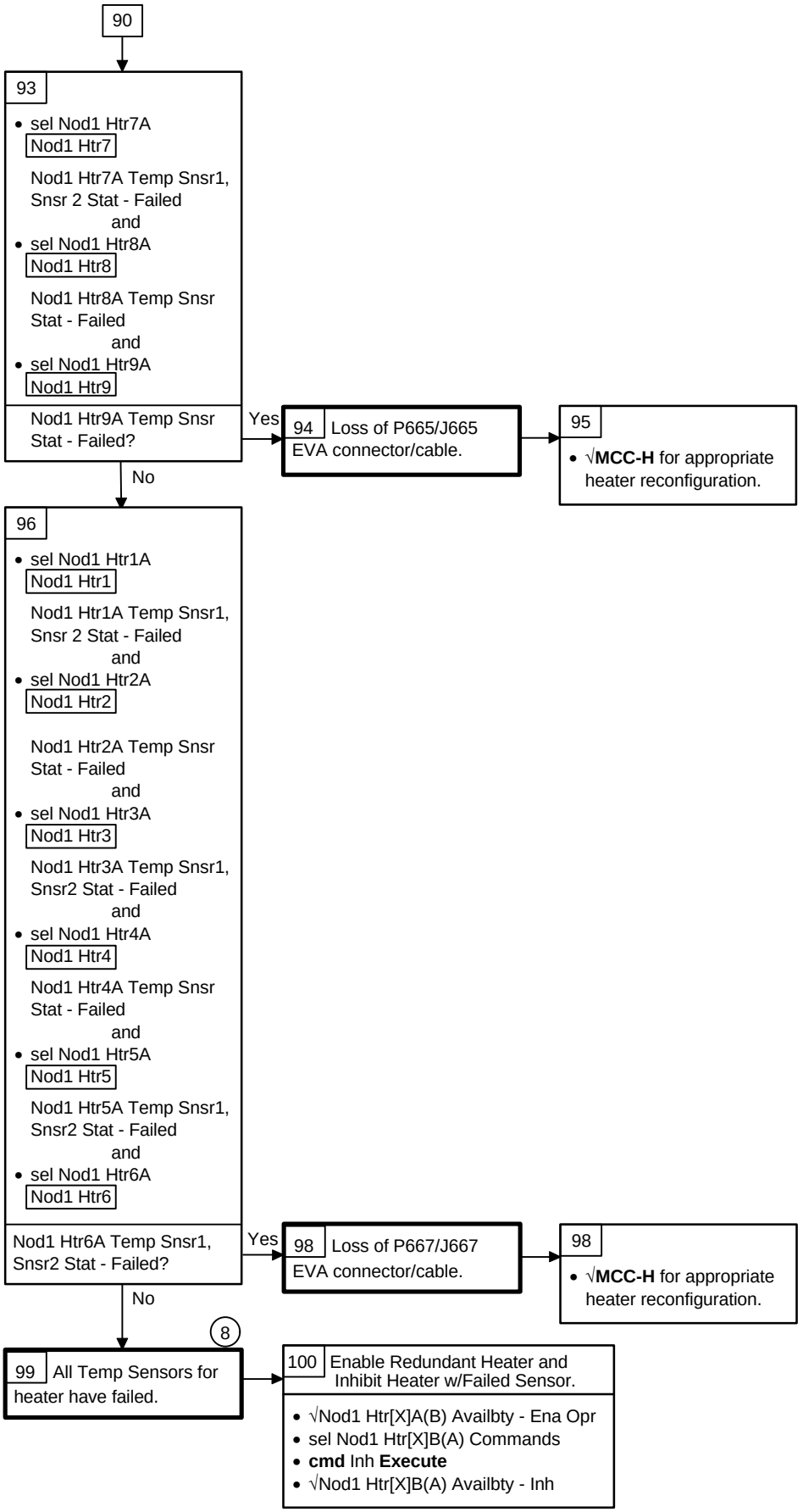


(7) Temperature of one sensor is less than its lower setpoint; temperature of the redundant sensor is greater than its upper setpoint. Software will command the heater off (default state).

NODE 1 SHELL HEATER FAILURE (Cont)



NODE 1 SHELL HEATER FAILURE (Cont)



(8) Temp sensor(s) have failed range check. Temp reading is either higher than +400°C or lower than -350°C. Software will command heater off (default state).

PMA 1 SHELL HEATER FAILURE

Advisory:
PMA1 Htr[X] B(A) Faild

User Notification

PCS NODE 1: TCS
NODE1: TCS
'PMA1'
sel PMA1 Htr[X]B(A)

Health Stat - Faild

PCS NODE 1: TCS
NODE1: TCS
'PMA 1'

Attention symbol appears next to PMA1 Htr[X]B(A)

Nominal Stage Config:
nav NODE 1: TCS
NODE1: TCS
'PMA1'
PMA1 Htr [X]B
Availbty - Ena Opr

PMA1 Htr [X]A
Availbty - Ena BU

RPCM N1RS2C
RPC 1, 2,14, 16 Close Command - Ena

RPCM N1RS1C
RPC 1, 14, 15, 16 Close Command - Ena

Nominal Assembly Config:
During Pre-Ingress Warmup, Ingress, and Post-Egress Dryout, the heater availability will be variable (limited by power and zone temperature priorities). This procedure accounts for these periods as well as the nominal

1 Check Heater Failure Flags.

PCS NODE1: TCS
NODE1: TCS
'PMA1'

- sel PMA1 Htr[X]B(A)
- Determine condition via failure flags:

Availbty - Inh and Cmd Stat - On	87
Hi Lim Violatn - True	5
Lo Lim Violatn - True	63
Temp Snsr Stat - Faild	2
RPC Position - Op and Cmd Stat - On	47
RPC Position - Cl and Cmd Stat - Off	19
RPC Position - Cl and Availbty - Inh	11
RPC - Trip	57

2 All B(A) Temp Sensors failed?
No → 92
Yes →

3 Possible loss of MDM Card N1-2 A02 (N1-1 A02).

4
- Perform MDM IO CARD FAILURE, all (SODF: C&DH), then
- √**MCC-H** for heater reconfiguration.

1

5 Temp >Temp Snsr Failure Upper Limit?
No → 6 Transient failure. → 7
- Continue nominal operations.

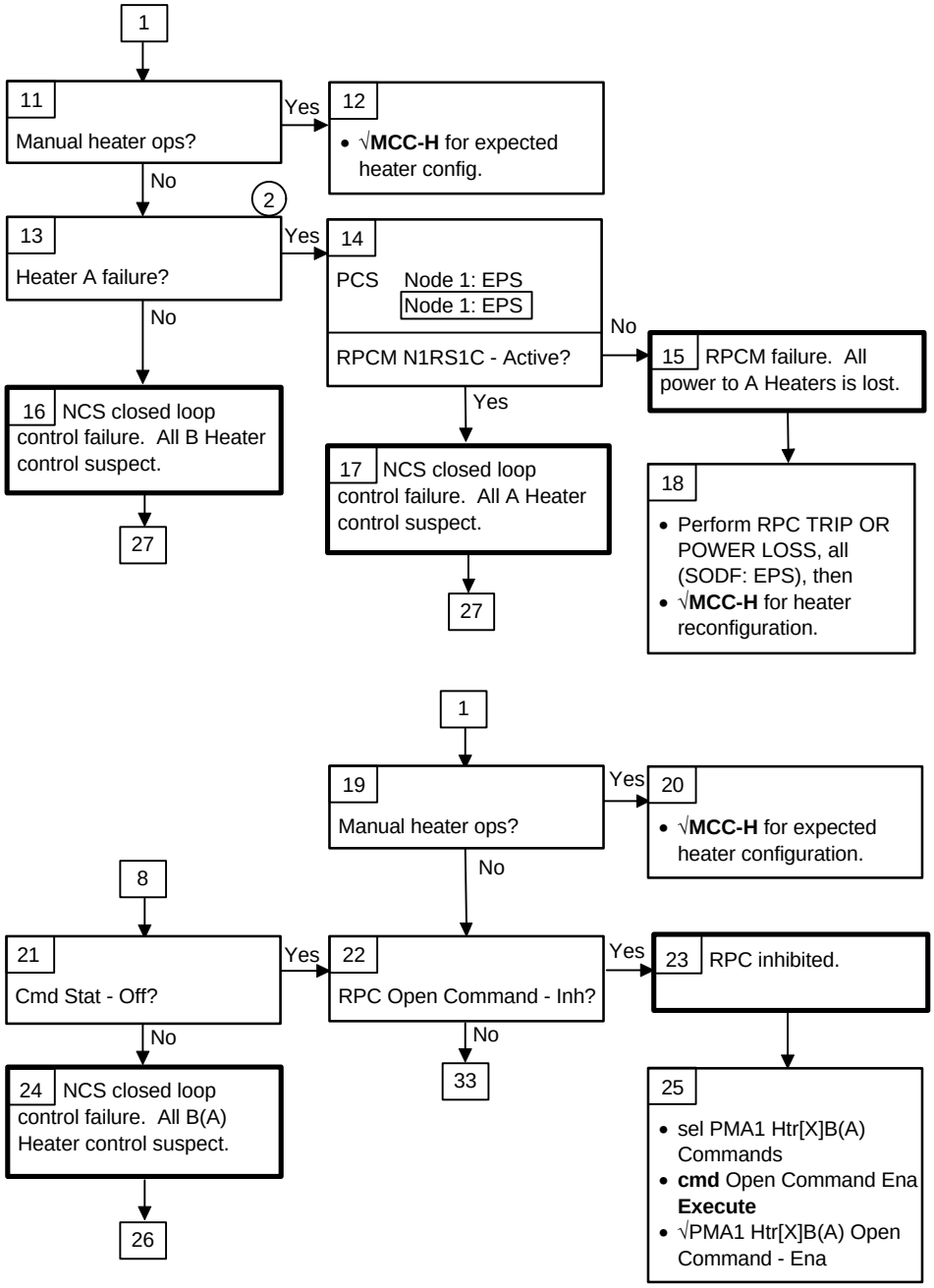
Yes →

8 RPC Position - Op?
Yes → 9 Possible transient hot thermal environment. (2) → 10
- √**MCC-H** for further action.

No → 21

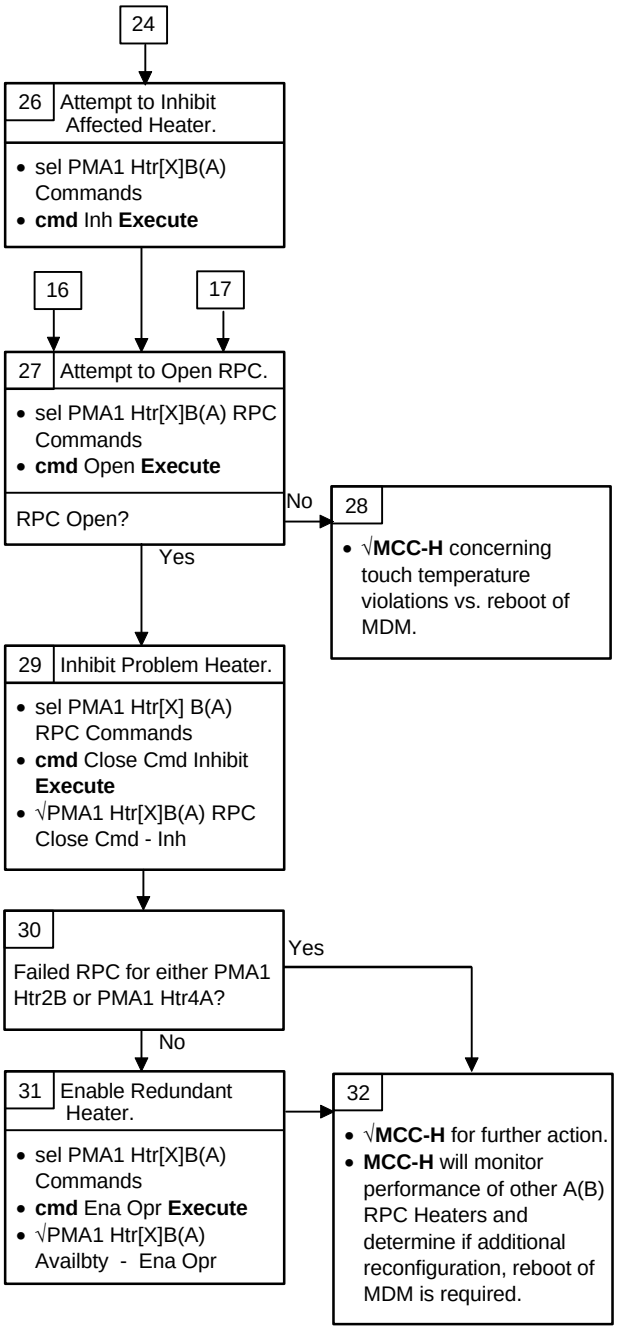
(1) Failure Upper Limit band may be set too small. **MCC-H** may unlink a change to Failure Upper Limit.

PMA 1 SHELL HEATER FAILURE (Cont)

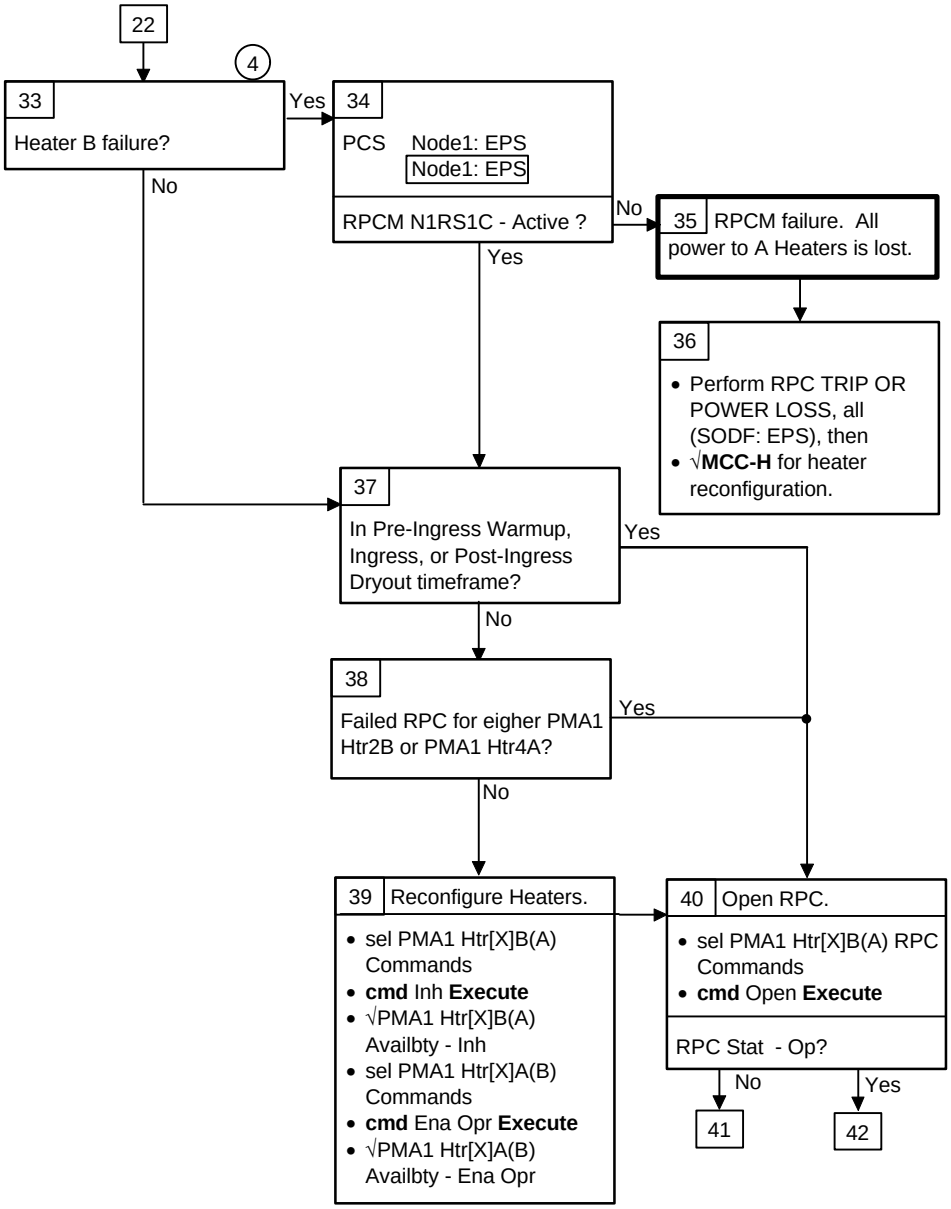


(2) The A Heaters are connected to the same RPCM as MDM N1-1. The MDM Failure malfunction will be worked in that case. The B Heaters are not connected to the same RPCM as MDM N1-2; therefore, it is possible that the heater configuration problem could be detected before the RPCM failure.

PMA 1 SHELL HEATER FAILURE (Cont)

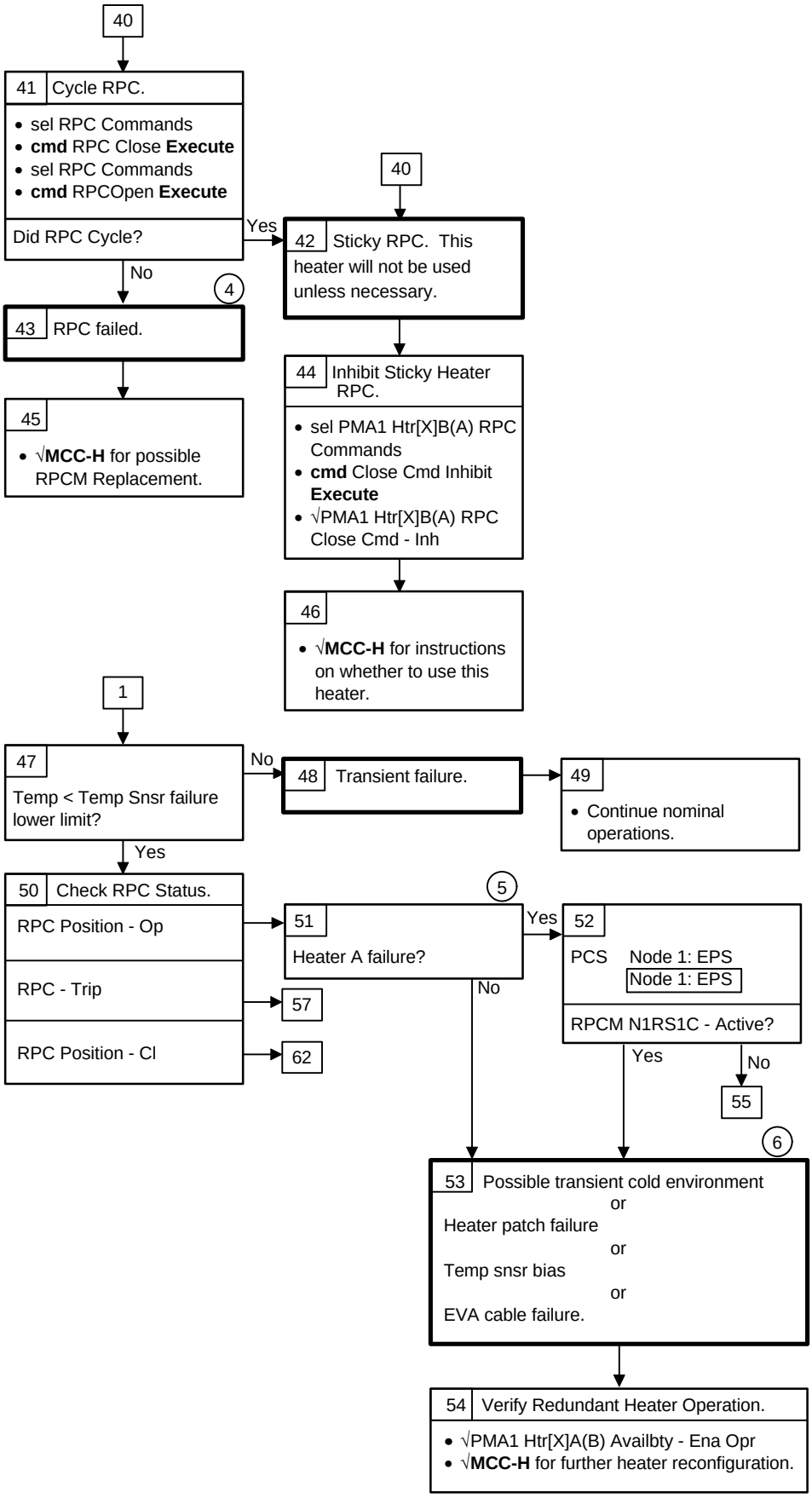


PMA 1 SHELL HEATER FAILURE (Cont)



(4) The B Heaters are connected to the same RPCM as MDM N1-2. The MDM Failure malfunction will be worked in that case. The A heaters are not connected to the same RPCM as MDM N1-1; therefore, it is possible that the heater configuration problem could be detected before the RPCM failure.

PMA 1 SHELL HEATER FAILURE (Cont)

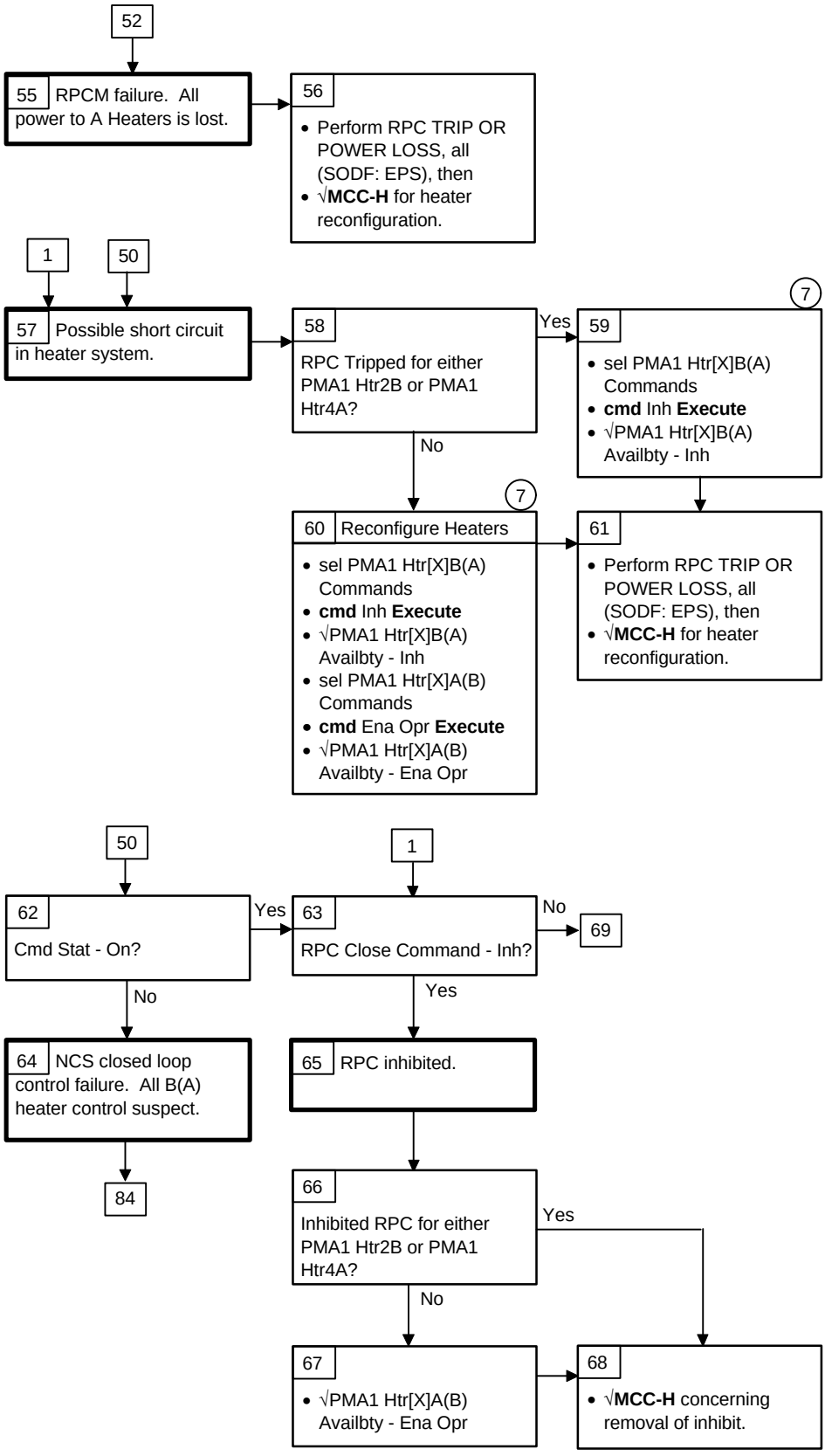


(4) **MCC-H** will evaluate the possibility of touch temperature violations and consequences of leaving the heater on.

(5) The B Heaters are connected to the same RPCM as MDM N1-2. The MDM failure malfunction will be worked in that case. The A Heaters are not connected to the same RPCM as MDM N1-2; therefore, it is possible that the heater configuration problem could be detected before the RPCM failure.

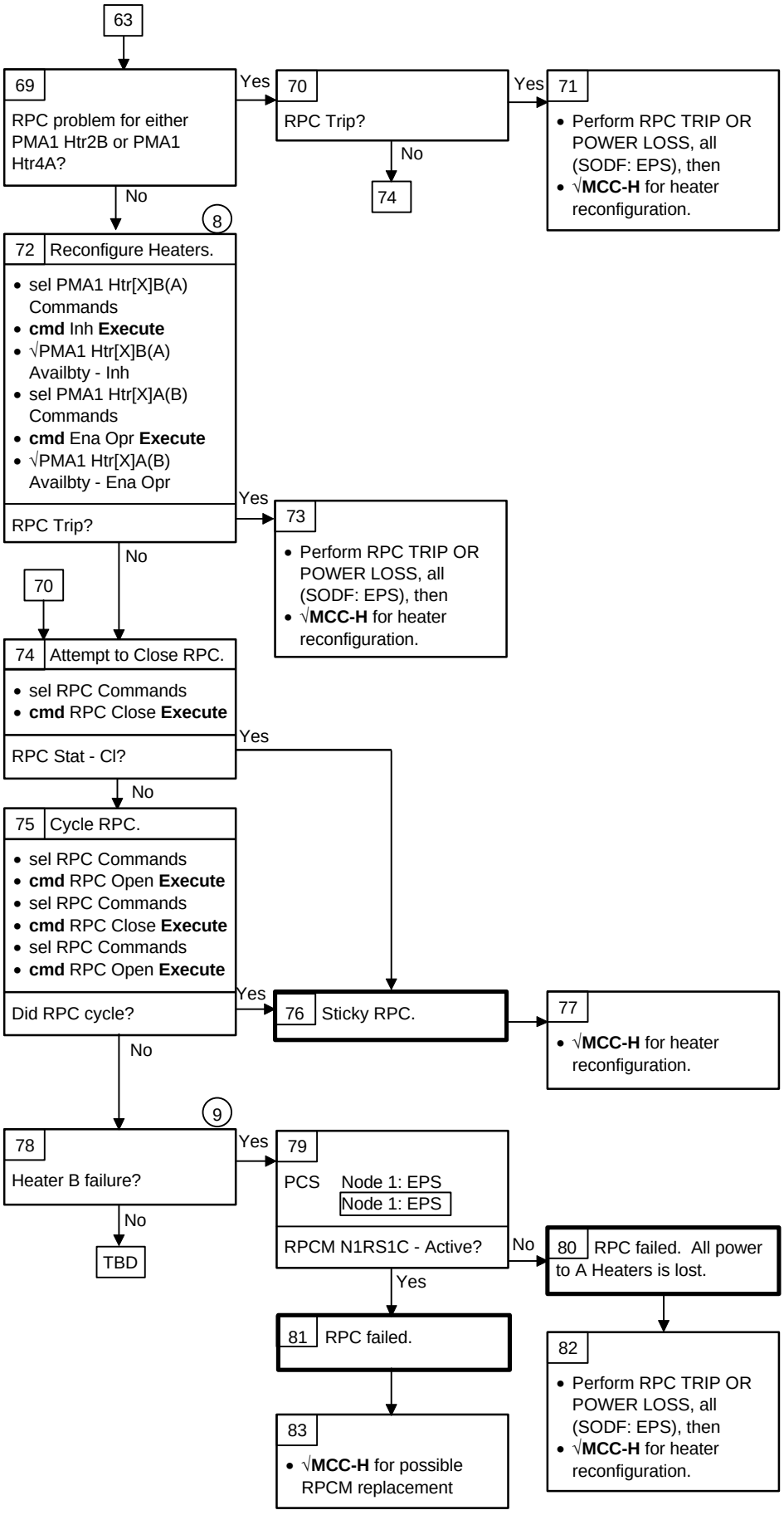
(6) A transient cold environment could require both B and A heaters to keep temperatures within limits. A heater pad debonding failure could also be the culprit in this case. If all B(A) temperatures do not appear to be rising properly, the failure could be in the EVA cable/connectors P672/J672 (B Heaters) or P666/J666 (A Heaters).

PMA 1 SHELL HEATER FAILURE (Cont)



(7) Since the RPC has tripped once, it will not be used again unless necessary.

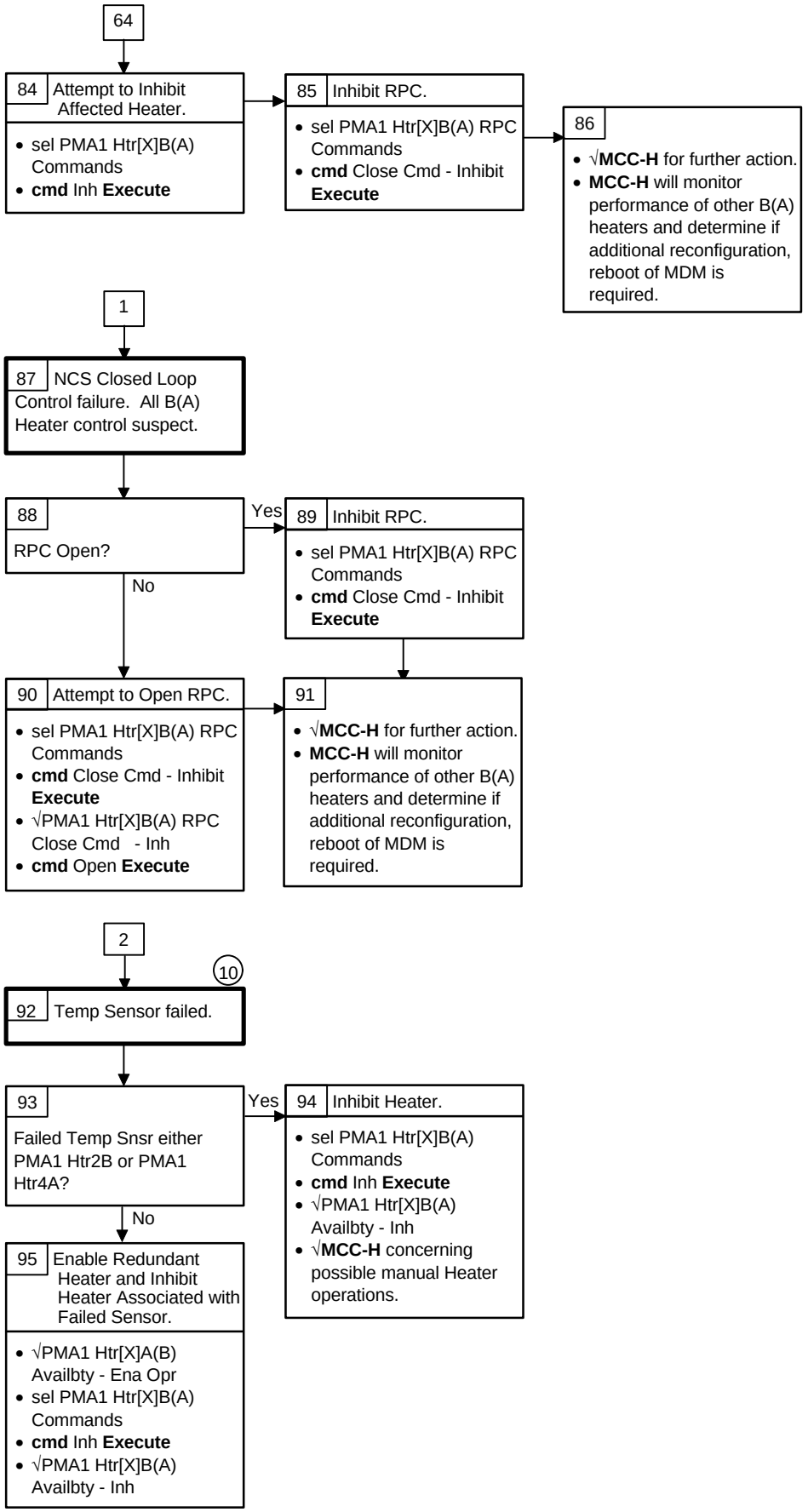
PMA 1 SHELL HEATER FAILURE (Cont)



(8)
Since the shell is in a cold condition, the back-up heater should be enabled.

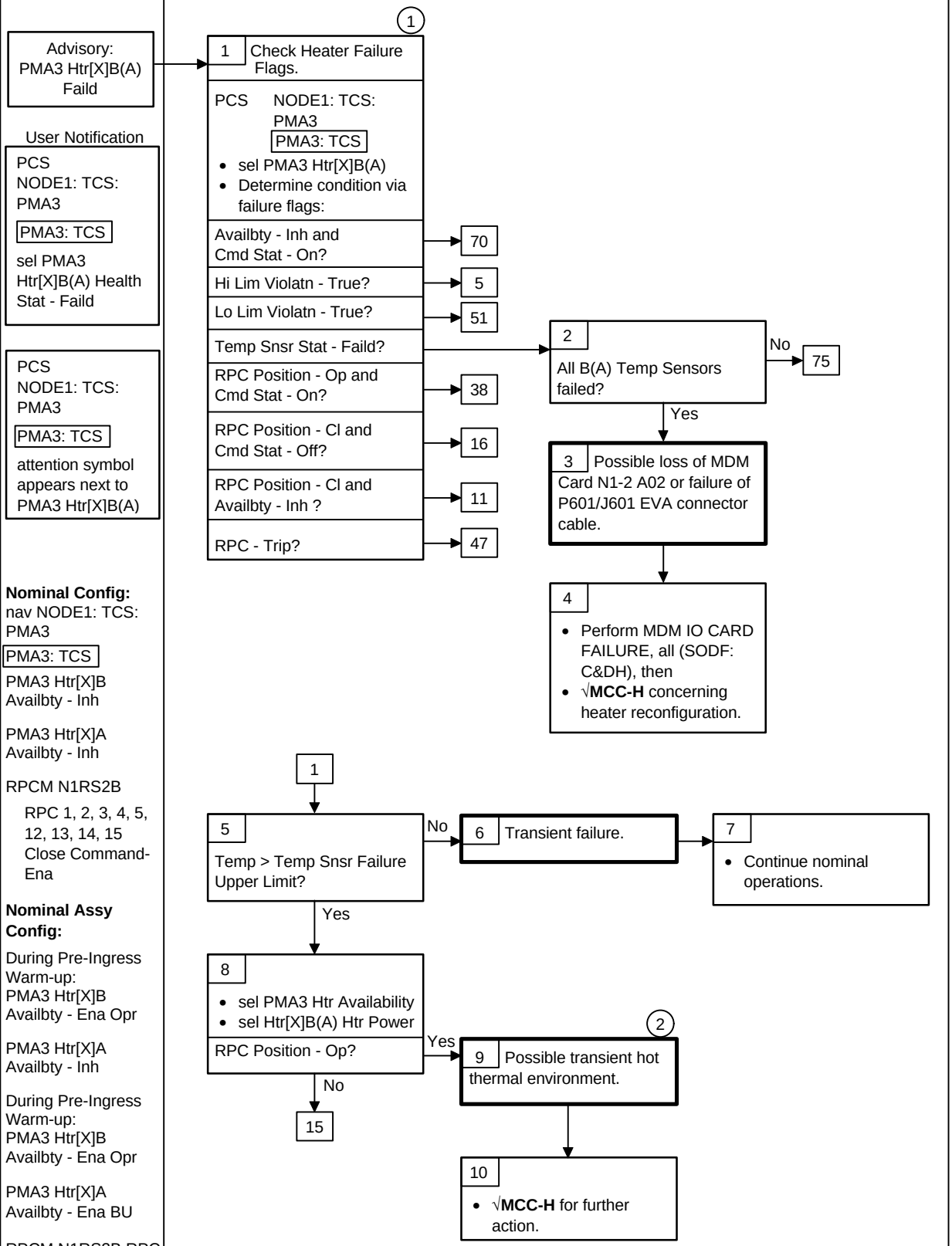
(9)
The B Heaters are connected to the same RPCM as MDM N1-2. The MDM failure malfunction will be worked in that case. The A Heaters are not connected to the same RPCM as MDM N1-1; therefore, it is possible that the heater configuration problem could be detected before the RPCM failure.

PMA 1 SHELL HEATER FAILURE (Cont)



(10) Temperature sensor has failed its range check. Temperature is either higher than +400°C or lower than -350°C. Software will command the heater off (default state).

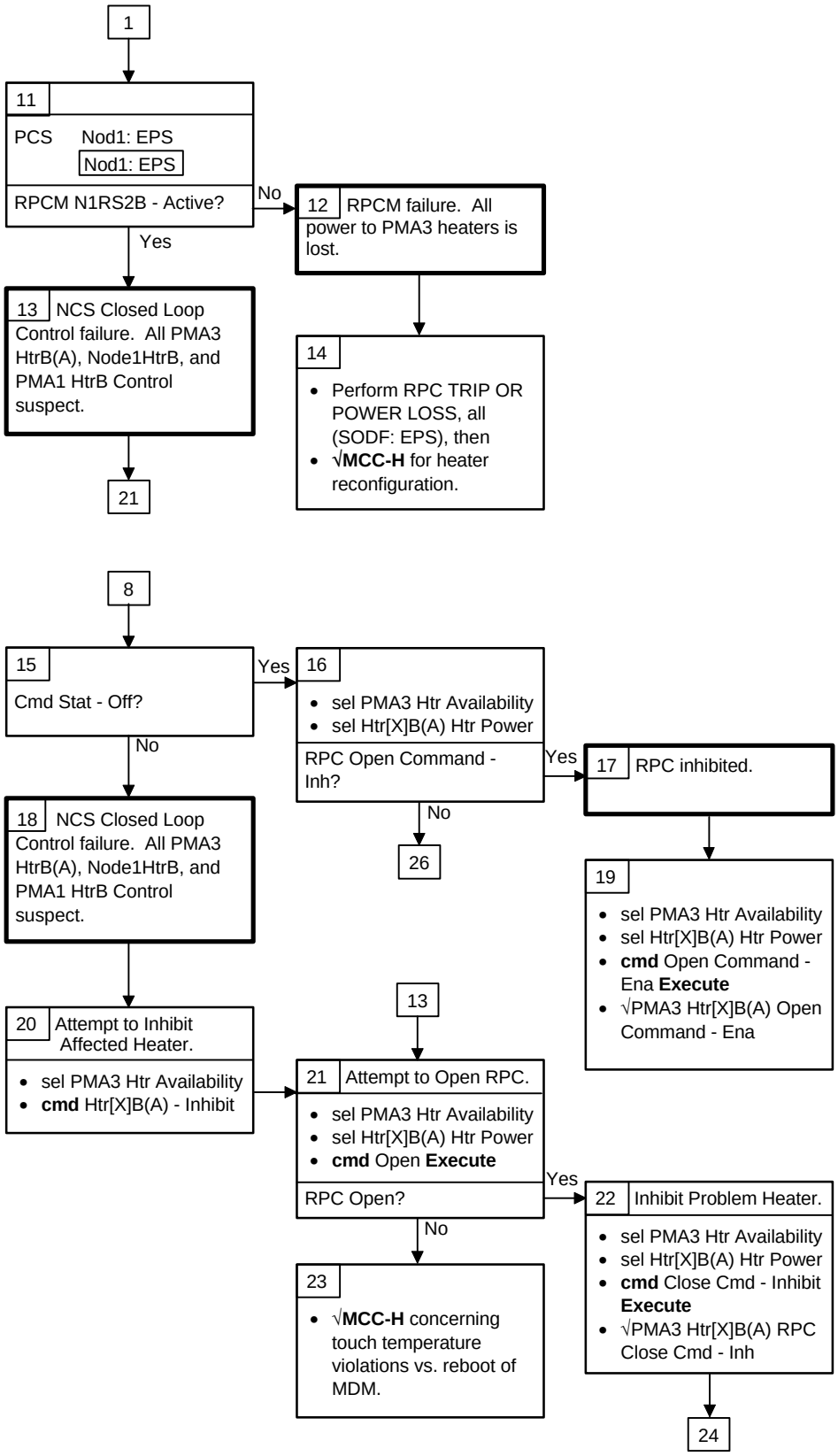
PMA 3 SHELL HEATER FAILURE



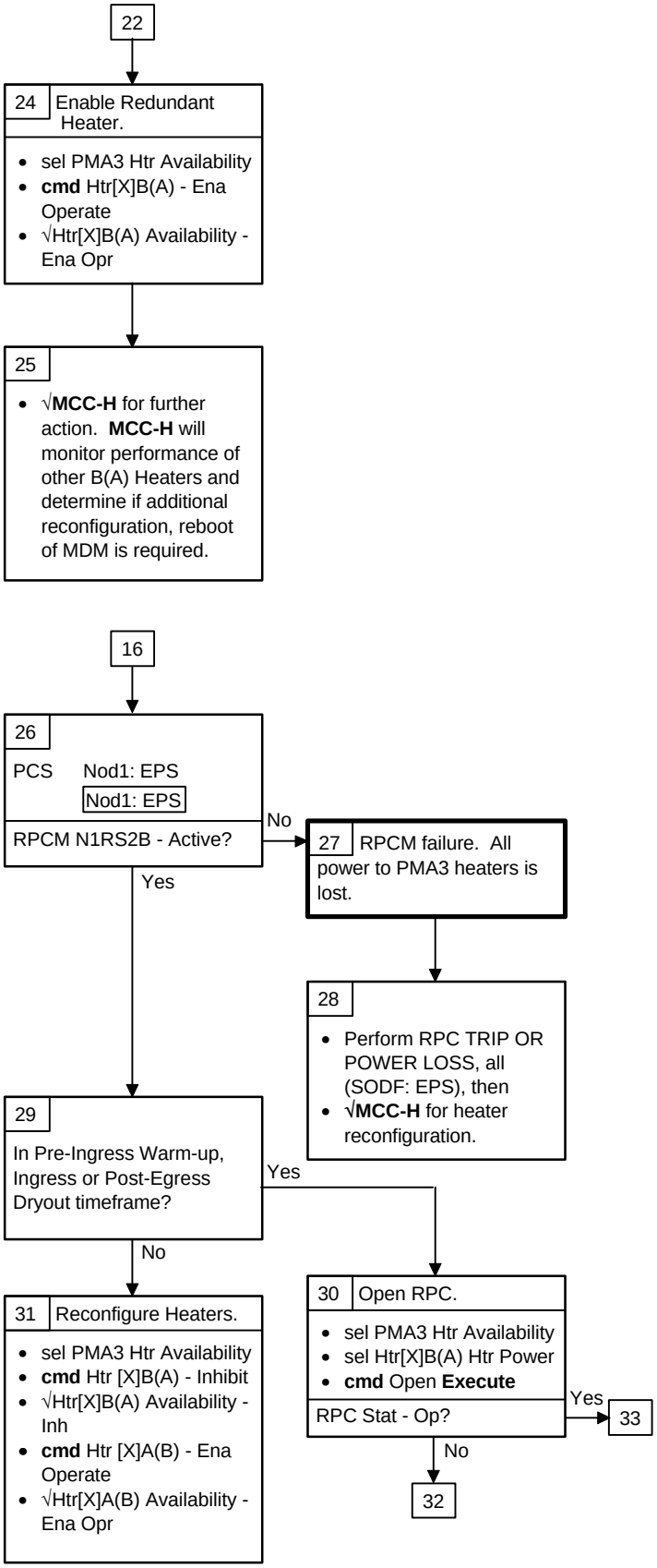
1 The PMA3 Htr A,B designation is for physical redundancy only. Both the A and the B heater strings are controlled by the N1-2 MDM and powered by the N1-RS2 RPCM.

2 Failure Upper Limit band may be set too small. **MCC-H** may uplink a change to Failure Upper Limit.

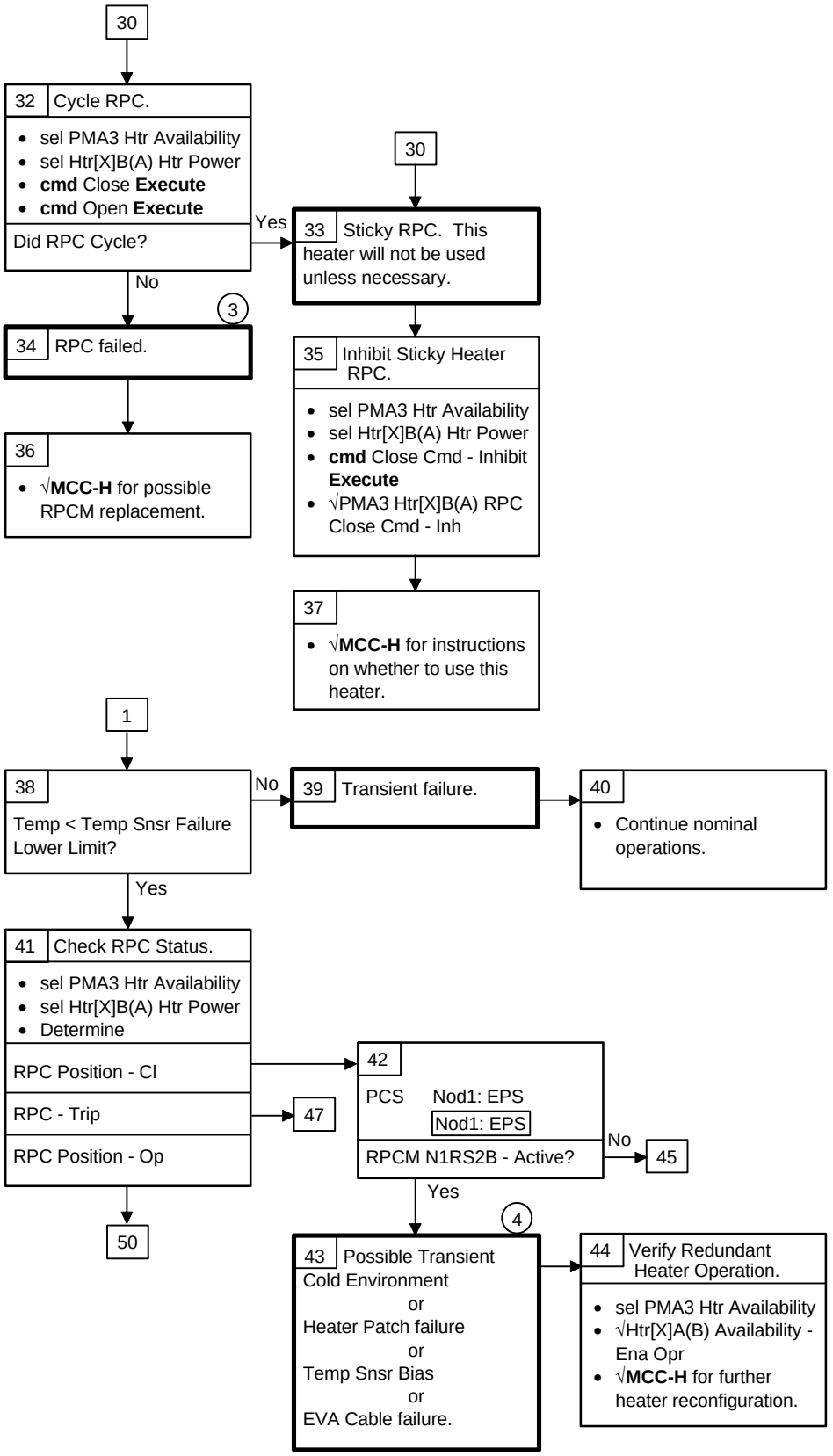
PMA 3 SHELL HEATER FAILURE (Cont)



PMA 3 SHELL HEATER FAILURE (Cont)



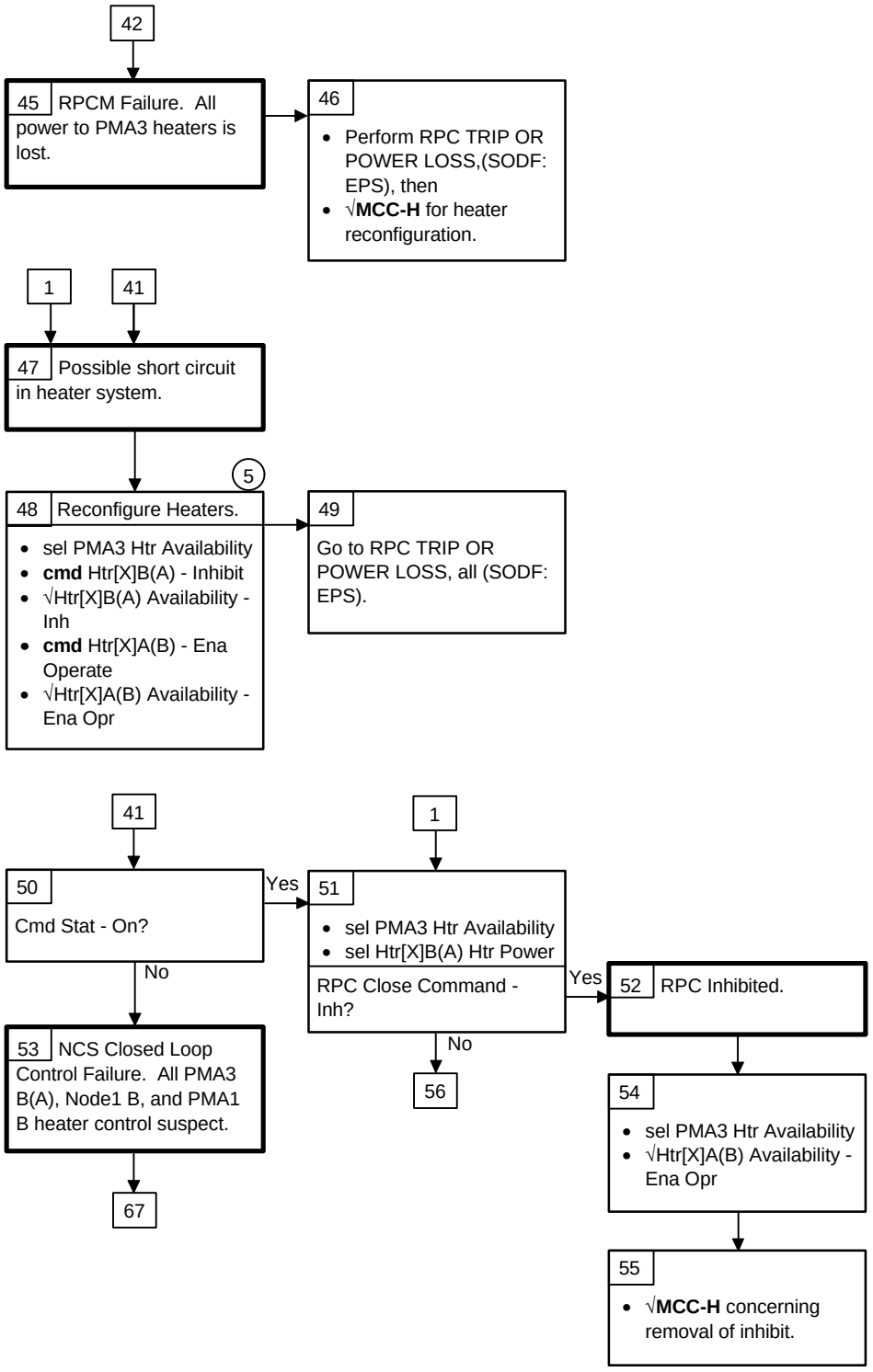
PMA 3 SHELL HEATER FAILURE (Cont)



(3) **MCC-H** will evaluate the possibility of touch temperature violations and consequences of leaving the heater on

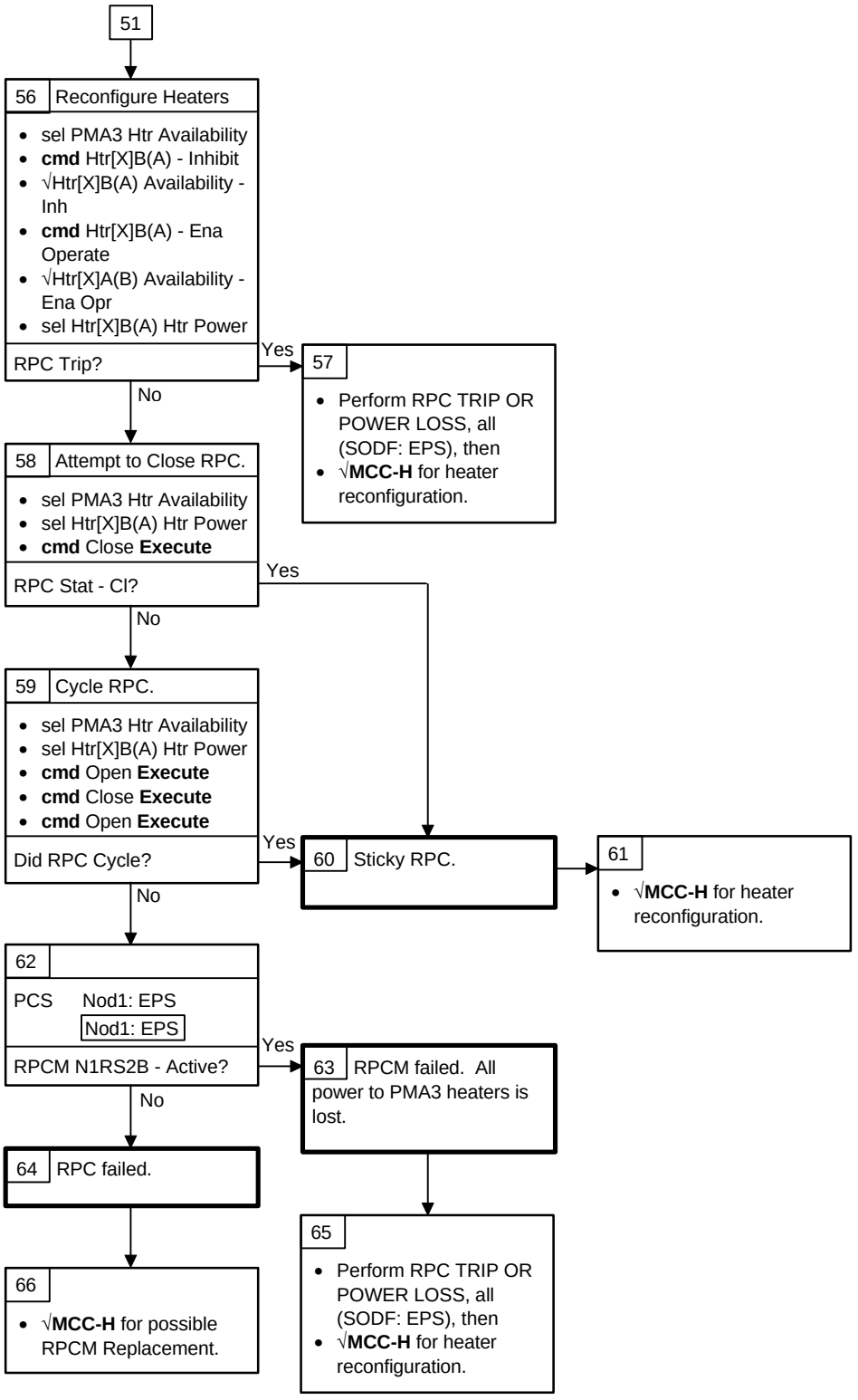
(4) A transient cold environment could require both B and A heaters to keep temperatures within limits. A heater pad debonding failure could also be the culprit in this case. If all B(A) temperatures do not appear to be rising properly, the failure could be in the EVA cable/connectors P602/J602.

PMA 3 SHELL HEATER FAILURE (Cont)



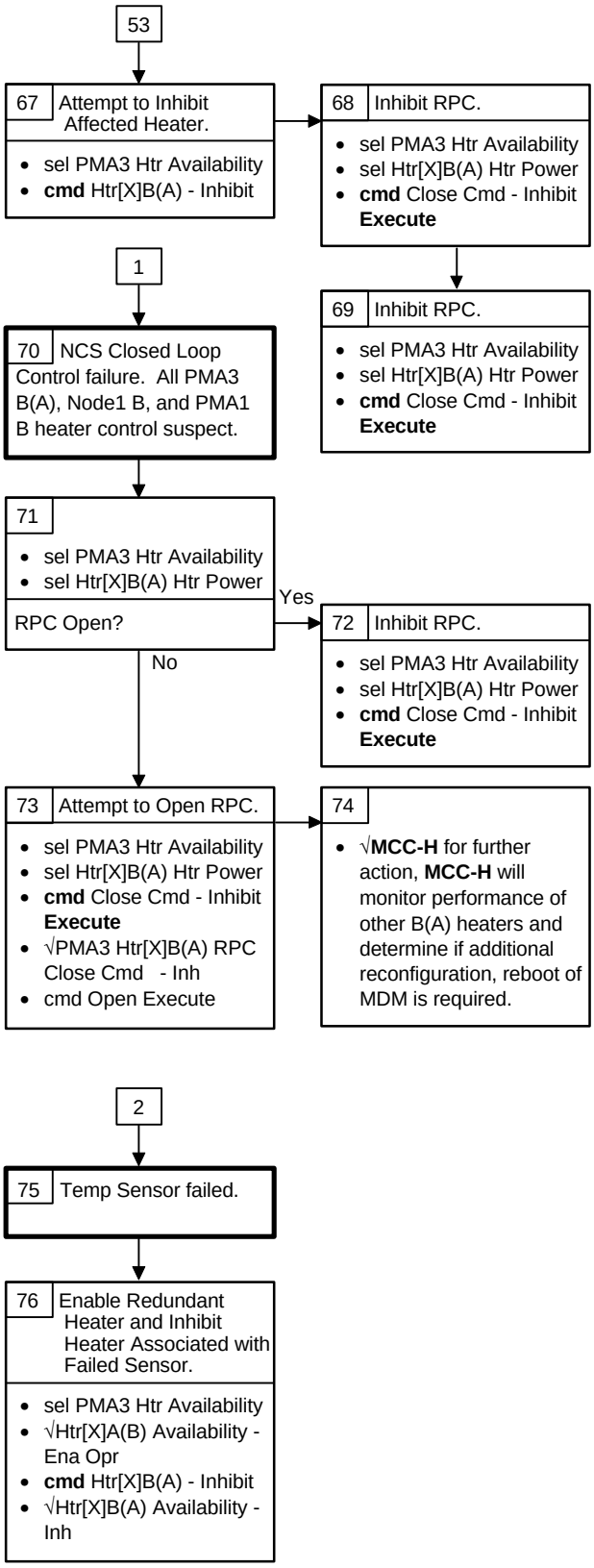
(5) Since the RPC tripped, it will not be used again unless necessary.

PMA 3 SHELL HEATER FAILURE (Cont)



(6) Since the shell is in a cold condition, the back-up heater should be enabled.

PMA 3 SHELL HEATER FAILURE (Cont)



(7) Temperature sensor has failed its range check. Temperature is either higher than + 400°C or lower than - 350°C. Software will command the heater off (default state).

Z1 DOME CBM HEATER FAILURE

Condensation in Z1 Dome

Nominal Config:
PCS NODE1:EPS

NODE1:EPS

sel RPCM N14B B

RPC 3 - Cl

RPC 3 Close Cmd - Enable

RPC 3 Close Cmd - Enable

1

1 Check RPC Status.

PCS NODE 1: EPS
NODE 1: EPS

- sel RPCM N14B B

RPC 3 - Closed?

Yes → 2 Possible Open Circuit failure
or
Possible transient cold thermal environment.

2 →

5

- √**MCC-H** for further action.

No

3 RPC 3 -Tripped?

No → 7

Yes

4 Heater short circuit.

6

- Perform RPC TRIP OR POWER LOSS, all (SODF: EPS), then
- √**MCC-H** for heater reconfiguration.

3

7 RPC Open, heaters are not powered.

8

- **cmd** RPC - Close **Execute**
- √RPC - Cl

(1) The Z1 Dome Heater system is a thermostatically controlled system connected to only one RPC. There is no insight into Dome temperature and no capability to perform any software functions (setpoint changes, etc.).

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CORRECTIVE PROCEDURES

CORRECTIVE

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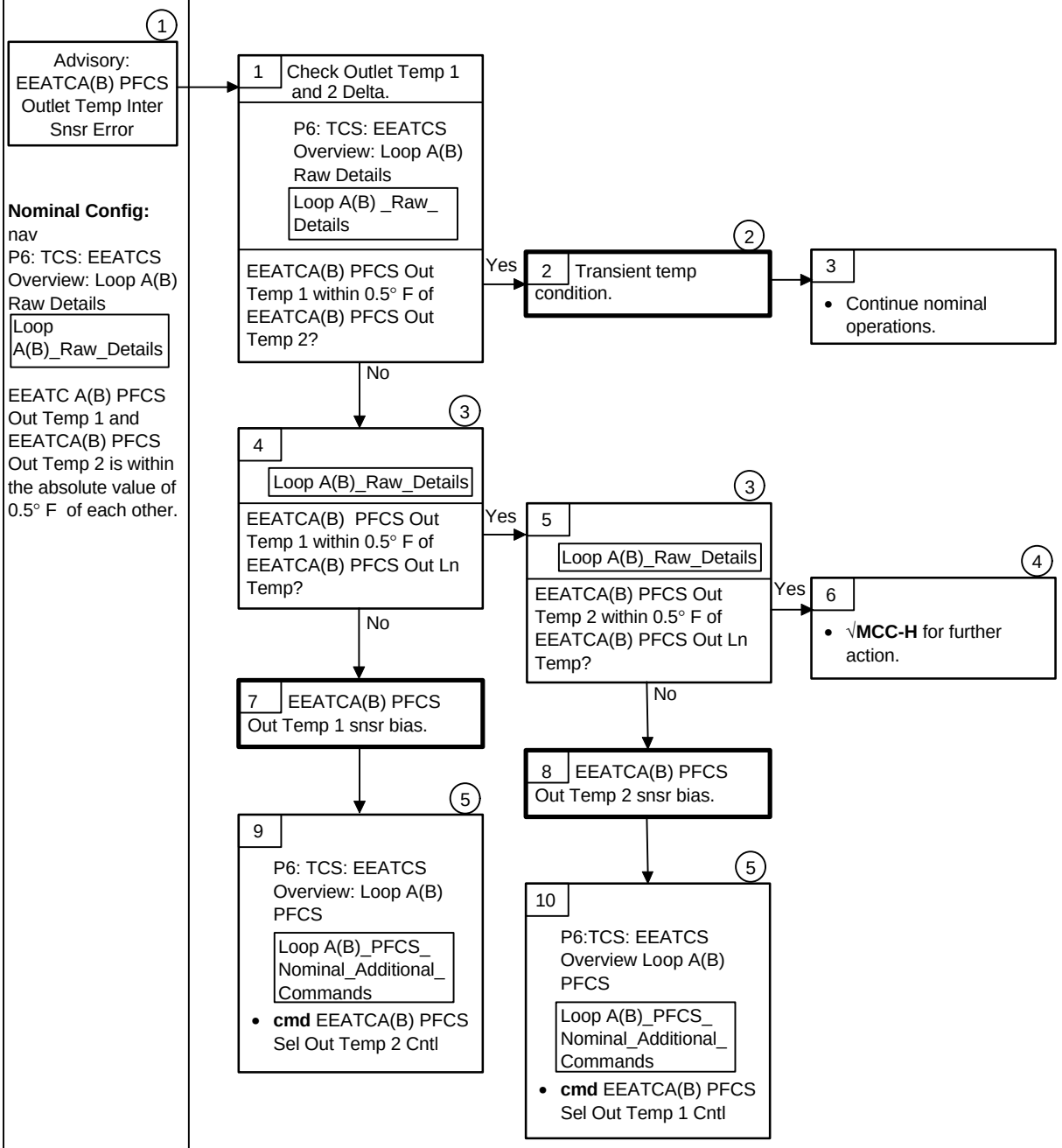
EEATC PFCS OUTLET TEMP INTER SENSOR ERROR



Nominal Config:
nav
P6: TCS: EEATCS Overview: Loop A(B) Raw Details
Loop A(B)_Raw_Details

EEATC A(B) PFCS Out Temp 1 and EEATCA(B) PFCS Out Temp 2 is within the absolute value of 0.5° F of each other.

(1) The PVCA validates the absolute values of the PFCS Outlet Temps against each other looking for sensor drift. The absolute temperature difference between the two sensors should be within 0.5° F of each other. This validation check has failed here.

(2) The temperature reading tripping the advisory flag is possibly a sporadic temperature reading that could have been triggered by a transient temperature condition. This failure condition is cleared when the temperature returns within the limit within three consecutive readings.

(3) A Delta check of .5° F between the PFCS Out Temps and the Outlet Line Temp is pending on further analysis or trending data.

(4) **MCC-H** will view the trending data and determine what course of action to take.

(5) Select PFCS Out Tx as the temperature to be used in the control function due to the bias of the other sensor.

EEATC PFCS OUTLET TEMP INTRA SENSOR ERROR

(1) Advisory: EEATCA(B) PFCS Outlet Temp 1 Intra Snsr Error

(1) Advisory: EEATCA(B) PFCS Outlet Temp 2 Intra Snsr Error

(1) Advisory: EEATCA(B) PFCS Out Ln Temp Intra Snsr Error

Nominal Config:
The most recent Temp for EEATCA(B) PFCS Out Temp 1, EEATCA(B) PFCS Out Temp 2, and EEATCA(B) PFCS Outlet Line Temp is within the absolute value of | 0.025° C | of the previously read sensor value.

(2)

1 Check Temp Delta.

P6: TCS: EEATCS Overview: Loop A(B) Raw Details

Loop A(B)_Raw_Details

Is EEATCA(B) PFCS Out Temp 1 within | 0.025° C | of EEATCA(B) PFCS Out Temp 2 and EEATCA(B) Out Ln Temp? — Yes

Is EEATCA(B) PFCS Out Temp 2 within | 0.025° C | of EEATCA(B) PFCS Out Temp 1 and EEATCA(B) Out Ln Temp? — Yes

Is EEATCA(B) PFCS Out Ln Temp within | 0.025° C | of EEATCA(B) PFCS Temp1 and EEATCA(B) PFCS Temp 2? — Yes

No

2 Transient temp condition.

3
- Continue nominal operations.

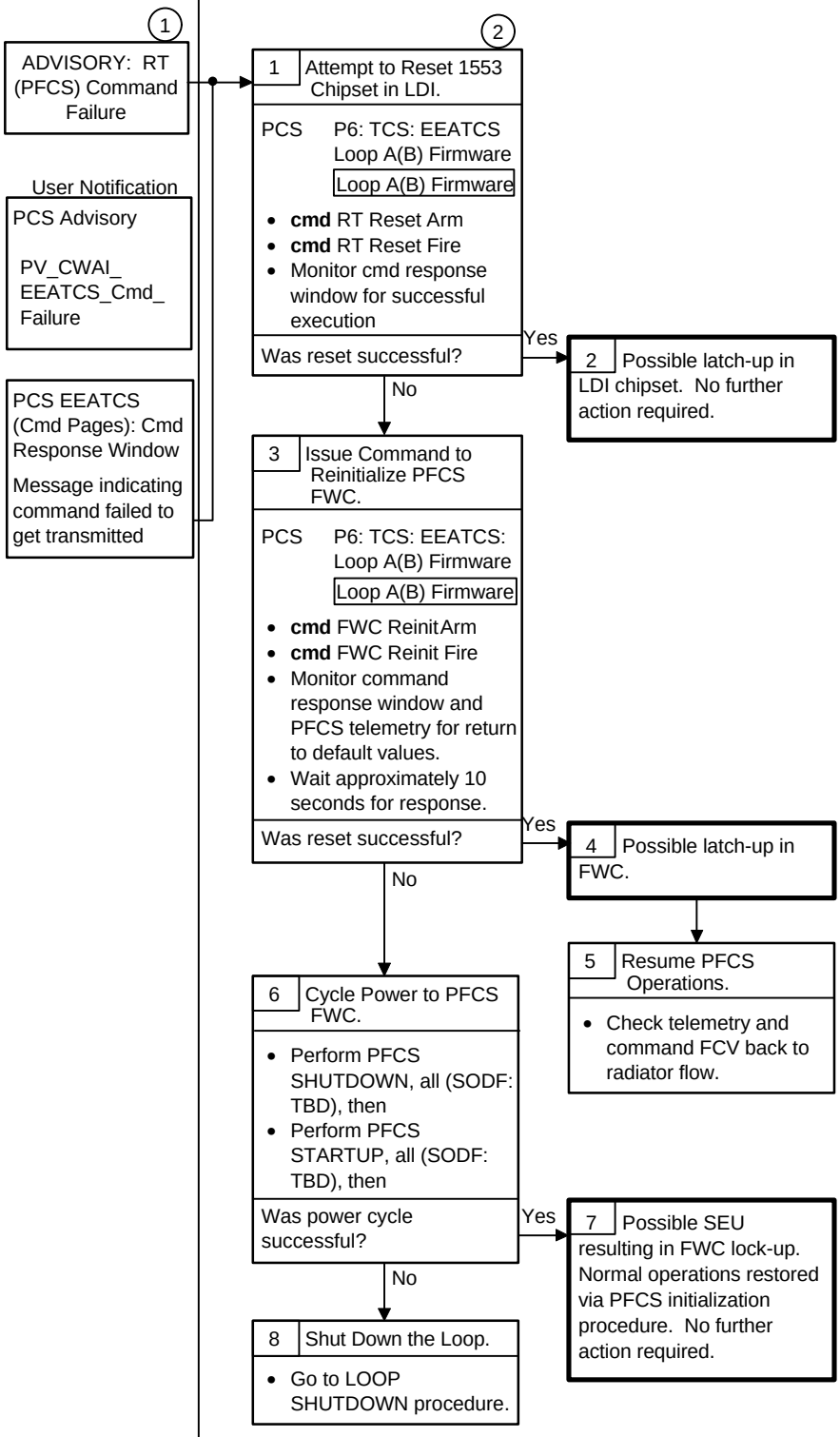
4
- √**MCC-H** for further action.

(1)
The PVCA validates the absolute value of the most recent PFCS Outlet Temp 1, PFCS Outlet Temp 2, and PFCS Outlet Line Temp against the previous value of the same sensor.
The absolute temperature difference between the two readings should be within | 0.025° C | of each other.

(2)
The temperature reading tripping the advisory flag is probably a sporadic temperature reading that could have been triggered by a transient temperature condition. This failure condition is cleared when the temperature returns within the limit for three consecutive readings.

(3)
Trending data capability is available on the ground only; therefore, **MCC-H** will view the trending data for PFCS Outlet Temp 1, PFCS PFCS Outlet Line Temp, and determine what course of action to take.

EEATC PFCS RT COMMAND FAILURE



(1)
PVCA application generates this caution message after having tried to issue the command three times (twice over the primary 1553 channel and once over the redundant). Absence of a loss of comm warning indicates that the PVCU is still able to receive data from the PFCS.

(2)
The failed command will be latched in the PVCU DRAM and has to be cleared via specific command.

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CAUTION MESSASGES

CAUTION

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CAUTION

TCS CAUTION MESSAGE TABLE

Message Text	Condition	Action
SPDA Z13B(4B) Heater A(B) Failed - Z1	TBD	TBD
PV4B(2B) EEATCS PFCS Pump A(B) Failure	TBD	TBD
PV4B(2B) EEATCS PFCS Warm FCV Recal Condition	TBD	TBD
PV4B(2B) EEATCS PFCS FCV Recal Failure	TBD	TBD
PV4B(2B) EEATCS PFCS Fluid Leak Condition	TBD	TBD
PV4B(2B) EEATCS PFCS Min Outlet Temp Violation	TBD	TBD
PV4B(2B) EEATCS PFCS Min Inlet Temp Violation Condition	TBD	TBD
PV4B(2B) EEATCS Max Outlet Temp Violation Condition	TBD	TBD
PV4B(2B) EEATCS PFCS Outlet Temps 1&2 Invalid Data Condition	TBD	TBD
PV4B(2B) EEATCS PFCS ORU Failure	TBD	TBD
PV4B(2B) EEATCS PFCS Loss of Comm	TBD	TBD
PV4B(2B) EEATCS PFCS Invalid Data Condition	TBD	TBD

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